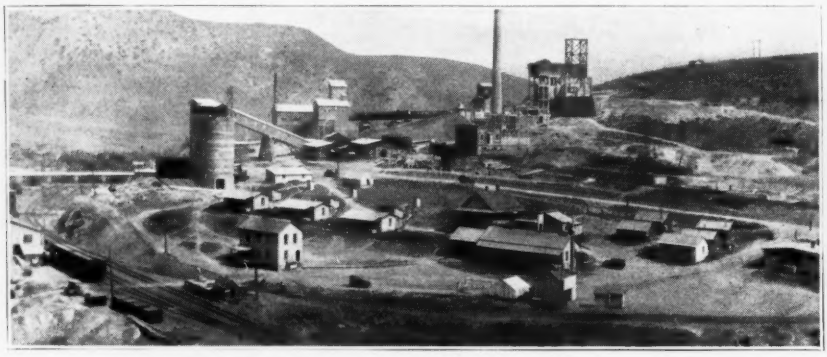
Pit and Quarry

SAND ▪ GRAVEL ▪ STONE

HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING

Sun Portland Cement Company Uses a Type "B" Buckeye Dryer



The Plant of the Sun Portland Cement Company, Lime, Ore.

Under date July 6, 1925 Mr. H. L. Knappenberger, Manager, says:-

"The Buckeye Dryer which we have installed here is giving every satisfaction and we have no cause for complaint of any kind, and to date have not spent anything for maintenance charges."

ROCK, SAND, GRAVEL, ORE, COAL

There's a BUCKEYE for every drying problem

Write for illustrated booklet.

THE BUCKEYE DRYER COMPANY

1351 Railway Exchange Bldg., Chicago

July 15, 1925

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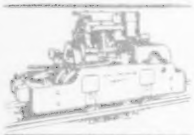
Circulation 7,600

Whitcomb Haulage Insurance

When you buy Whitcomb Locomotives you buy "haulage insurance."

Nineteen years of specialization in locomotive building insures correctness of design, workmanship and materials—resulting in locomotives which operate *economically, efficiently* and with a *minimum of maintenance cost.*



THE FIRST SUCCESSFUL GASOLINE LOCOMOTIVE WAS BUILT IN 1906 IT WAS A WHITCOMB

Operators of "Whitcomb's" express themselves as being thoroughly satisfied with their performance and greatly surprised at the pulling power, which is usually 50% greater than steam locomotives of a similar rating.

Put a "Whitcomb" to work on your next job and convince yourself of our claims that "Whitcombs" *insure* lower haulage costs.

GEO. D. WHITCOMB COMPANY

ROCHELLE - - - - - ILLINOIS

Representatives:

Machinery Corporation,
Apartado 76 B, Mexico City, D. F. Mexico

The General Supply Company of Canada, Ltd.
Ottawa, Ontario, Canada

GASOLINE-STORAGE BATTERY-ELECTRIC

WHITCOMB LOCOMOTIVES

Yes, you CAN get prompt delivery!

THE report has been going around that because of the record-breaking sales of steam ERIES during April and May, the buyer must take his turn and wait for delivery.

This is not correct.

By working our big ERIE plant day and night shifts, we have been able to keep our delivery schedule right up to orders.

We want you to know that an ERIE *Shovel or Crane can be shipped within twenty-four hours after receipt of contract.*

ERIE STEAM SHOVEL CO.

Erie, Pa., U. S. A.

Incorporated 1883. Formerly Ball Engine Co.
Builders of ERIE Shovels, Cranes, Draglines, Trench Hoes, etc.
Branch Offices: Boston, New York, Philadelphia, Atlanta, Pittsburgh, Chicago.

Representatives throughout the U. S. A.

It pays to use the *reliable*

ERIE Shovels and Cranes

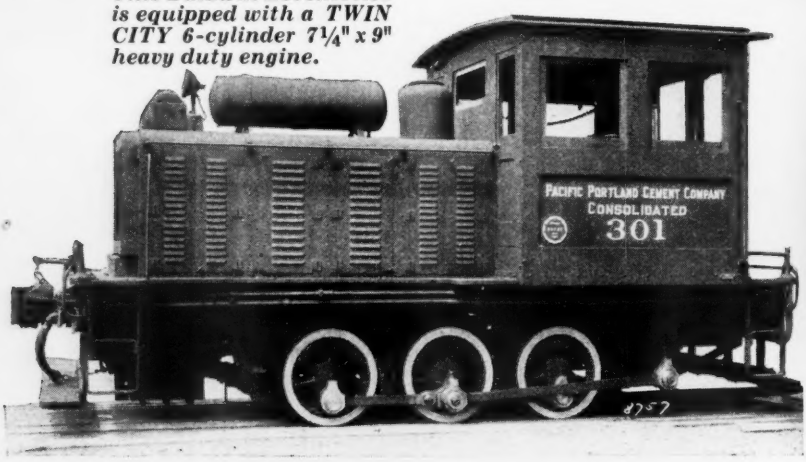
More than 3500 ERIES now in service—

April and May, 1925, broke our sales records for these two months—went above *any* previous year.

The general preference for the steam ERIE is due to its unequalled *reliability*. Carefully checked records, kept by hundreds of owners, show that ERIES cost only ⅓ as much for upkeep—and MAKE A CORRESPONDING SAVING IN WORKING TIME.

When you use ERIE Shovels and Cranes, you have the *certainty* of steady output.

This Baldwin Locomotive is equipped with a TWIN CITY 6-cylinder 7¼" x 9" heavy duty engine.



TWIN CITY ENGINES

THERE are many Baldwin locomotives used for switching and industrial haulage, powered with Twin City Engines.

A few of the many other firms using Twin City Engines as a part of their equipment are: Austin Machinery Corp., Buckeye Traction Ditcher Co., Bucyrus Co., Northwest Engineering Co., The Parsons Co., The Harnischfeger Corporation, Pennsylvania Pump & Compressor Co., Russell Grader Mfg. Co., Washington Iron Works, Willamette Iron & Steel Works, Star Drilling Machine Co., etc.

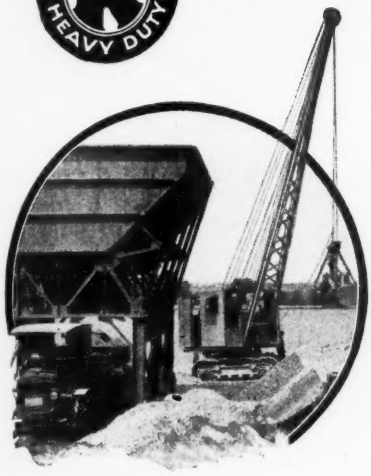
Specify Twin City Engines on *your* equipment. Manufactured in sizes 35 to 140 horsepower. Write for literature and specifications.

TWIN CITY COMPANY
MINNEAPOLIS, MINN.
Heavy Duty Engine Manufacturers Since 1903

"BUILT TO DO THE WORK"

KOEHRING

Crane



HOISTING, peaking, sluing, propelling; accuracy, ease and speed depend on the clutches.

The Koehring double outside band friction clutches give a new smoothness and accuracy to every operation as well as *Finger-tip control* at the operating levers.

66% greater clutch friction area gives remarkable ease and flexibility in operation — without losing the "feel" of the load — contributes to faster operation as well as to low maintenance and the elimination of clutch troubles.

Koehring clutch bands tighten from opposite sides of the drum, operating through an equalizing device which does away with all binding or side thrust on drum or bearing!

Write for Crane Bulletin No. Cr. 32

Go over the Koehring from multiplane to boom peak—you'll find Koehring improvement in design, Koehring Heavy Duty construction giving new factors to speed of operation, dependability, low maintenance and long service life.

Crane Capacities

No. 1 — 10 tons at 12 ft. radius. Clamshell buckets loaded with sand or gravel: 1 cu. yd. bucket weighing 3450 lbs. at 28 ft. radius, ¾ cu. yd. bucket weighing 2600 lbs. at 34 ft. radius. Boom lengths to suit conditions. 4 cylinder, 5 in. x 6 in. gasoline engine, 1000 R.P.M.

No. 2 — 15 tons at 12 ft. radius. Clamshell buckets loaded with sand or gravel: 1¼ cu. yd. bucket weighing 3850 lbs. at 32 ft. radius, 1 cu. yd. bucket weighing 3450 lbs. at 36 ft. radius, ¾ cu. yd. bucket weighing 2600 lbs. at 43 ft. radius. Boom lengths to suit conditions. 4 cylinder, 5¼ in. x 7 in. gasoline engine, 1000 R.P.M.

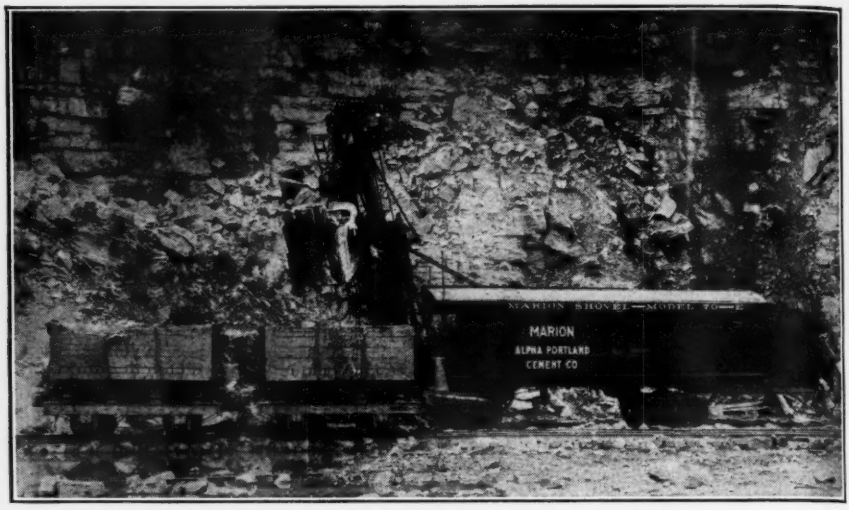
KOEHRING COMPANY MILWAUKEE WISCONSIN

PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

Sales Offices and Service Warehouses in all principal cities

Foreign Dept., Room 1370, 50 Church St., New York City.
Canada, Koehring Company of Canada, Limited, 105 Front St., East, Toronto, Ontario
Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D. F.

A 2785-III-IV



Marion Model 70 Railroad Type Electric operated by The Alpha Portland Cement Co., Continental, Mo.

No Pitmen Here

An engineer and a craneman can operate the Marion Model 70 Electric, mounted on Crawler Trucks, eliminating three or more pitmen. No rails to lay. No time lost in moving up. Propelling is so easily done that little time is required in moving back when blasting. Both steering and propelling are controlled directly by the engineer.

Come to Shovel Headquarters

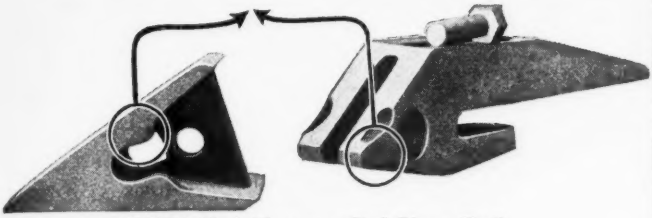
Marion Crawler Trucks are not designed for operation on soft ground in the same manner as small revolving machines on Crawling traction. They are primarily intended for use in quarries or similar places where a fairly solid and level foundation is obtainable. These Crawler trucks can be applied to Marion railroad type shovels now in use. For estimates give model and factory number.

MARION

The Marion Steam Shovel Co., Marion, Ohio, U. S. A.

AMSCO

These Safety Lugs—



AMSCO Clark Manganese Steel Dipper Tooth

as you know, were not placed on the Clark tooth for the sake of ornament. They serve a definite and indispensable purpose. The lugs on the point fit into corresponding lugs on the base to eliminate the effect of side thrust and to prevent spreading of the points.

They accomplish this purpose. And since the essential factors of design in the Amsco Clark Reversible Tooth are PATENTED, they are not to be found in any other two-part tooth.

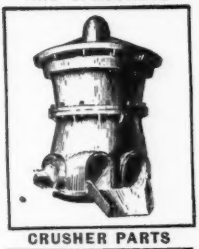
Our exchange offer

We have an exchange proposition on Clark Teeth, whereby, at slight expense, you can install them on any or all of your dippers. Hundreds of shovel operators have already taken advantage of this, and their favorable experience is your assurance of complete satisfaction. Write us for further information and prices.

Standard sizes of Clark teeth are carried in stock, and we have patterns or data for practically all types and sizes of teeth now in use.

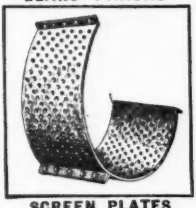
DIPPERS—TEETH

ALL TYPES OF CHAIN AND SPROCKETS



CRUSHER PARTS

GEARS—PINIONS



SCREEN PLATES OF ALL TYPES

AMERICAN MANGANESE STEEL CO.

General Offices: 388 E. Fourteenth St., Chicago Heights, Ill.

Foundries: Chicago Heights, Ill.; New Castle, Del.; Oakland, Cal.; Los Angeles, Cal.; Denver, Colo. Southern Manganese Steel Co., St. Louis, Mo.

Windings have best insulation obtainable. Mica used in slot portion of coils. Coils specially treated to seal all joints in the insulation, making them dust proof

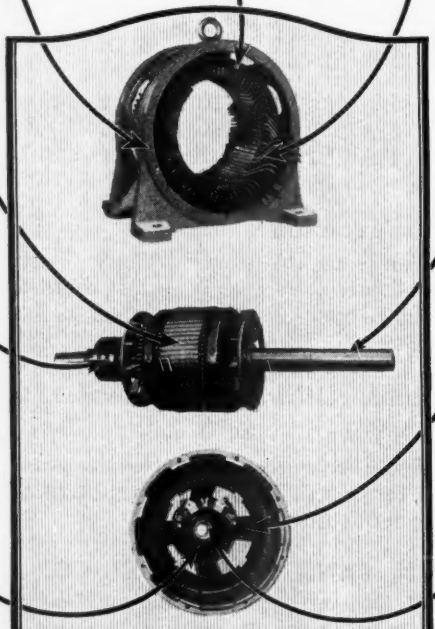
Sturdily designed frame to withstand shocks imposed by heavy duty service

Coils strongly braced by lacing each coil to an insulated steel ring in order to withstand mechanical vibration, surges, and extreme fluctuations in load

Features of the Westinghouse CW Wound-Rotor Motor which particularly adapt it to Cement Mill Service

Rotor designed to withstand shock and vibration. Form wound rotor coils are insulated for double normal voltage

Axle steel shaft



Collector rings shrunk on insulated sleeve which is pressed on shaft

Brackets have channel-shaped arms of liberal area which give great strength

Bearing housings and oil well are cast integral with the bracket

Bearing shells lined with high grade babbitt and easily removable. Bearings dust-tight and proof against oil leakage

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Sales Offices in All Principal Cities of the United States and Foreign Countries

W
WESTINGHOUSE ELECTRIC

Westinghouse

MEAD-MORRISON HOISTS

Rock of Ages granite being lifted by Mead-Morrison 3-Drum Hoist. Boutwell, Milne & Varnum Co., Montpelier, Vt.

If your hoist requirements call for safety, power and economy you can find what you want in the Mead-Morrison line.

Write for Catolog No. 24

MEAD-MORRISON
MANUFACTURING COMPANY
728 Prescott Street East Boston, Mass.
Welland, Canada
Branch Offices: New York, Chicago, Montreal

Rock Work— Yet Fast Digging

The powerful crowding motion of the P & H delivers maximum power to the digging end. The action is quick and positive and under the operator's control regardless of position of dipper stick.

P & H Model 200 Gasoline Shovel, owned by Byram & Jones, Contractors, Flat Top, Ala., working on a 45 ft. Rock Cut for Sloss-Sheffield R. R.

THE tremendous power and sure-footed traction of the P & H Gasoline Shovel answer the demands of digging wherever the going is the heaviest.

The new power clutch control—an exclusive feature in excavator control—makes the P & H the fastest and easiest gasoline operating shovel. A slight pull of the levers by the operator and the engine power does the rest.

Full power can be directed behind any motion—hoisting, swinging, traveling, or crowding—enabling the P & H to cut through hard materials such as rock, shale, frozen earth, etc.

P & H Gasoline shovels have opened the way to lower excavating and loading costs—increased profits—for many concerns. Let us mail you a copy of Bulletin 82-X. Address the nearest office.

HARNISCHFEGER CORPORATION

Successor to

PAWLING & HARNISCHFEGER CO.

Established in 1884

3851 NATIONAL AVENUE, MILWAUKEE, WIS.

New York	Chicago	Detroit	Portland	Seattle
Philadelphia	Kansas City	Dallas	Memphis	Minneapolis
Birmingham	San Francisco	Pittsburgh	Los Angeles	Jacksonville

Warehouse and Service Stations:

New York Memphis San Francisco Los Angeles Jacksonville Seattle

P&H GASOLINE SHOVEL

Power to Spare

There's no weak or irregular or uncertain work in digging where the Massillon Steam Shovel is concerned. Too much valuable time is lost by shovel operators because their machines are not dependable. The Massillon is always hard on the job, with power and strength to spare. It is dependable.

Mobility, ease of operation and interchangeable parts are also excellent qualities that contribute to the machine's dependability. Other qualities are accessibility and low maintenance.

If you are buying a new shovel, investigate the Massillon. Once you've read our literature you will better understand our claims for it. Send for descriptive book.

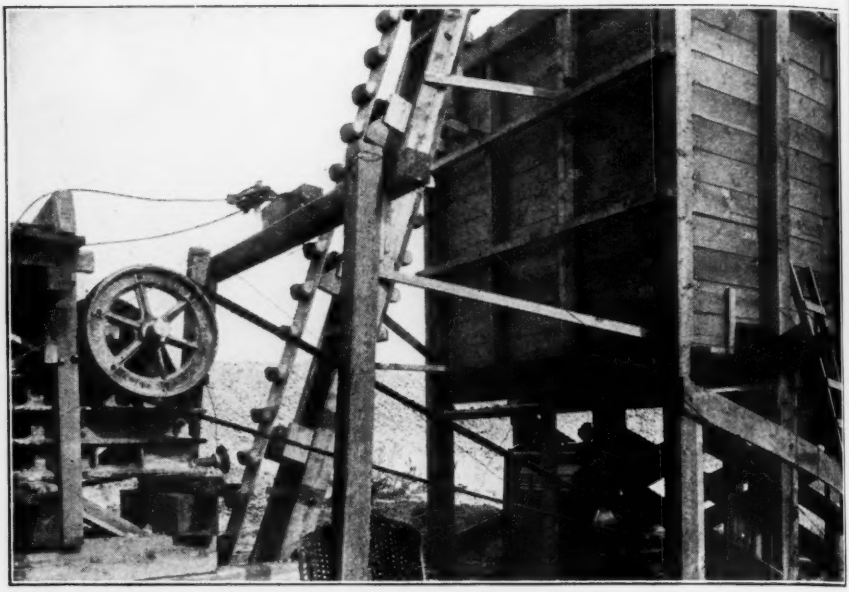
THE RUSSELL & CO.

MASSILLON, O.

(Established 1842)

The MODERN MASSILLON

Steam — 3/4 – 7/8 RANGE — Shovel



Stone crushing plant, powered with a 50 H. P. Model BTU Buda engine

Two men—and a Buda Engine

That's all it takes to run this entire plant—a ¾ type stone crusher that averages more than 40 yards an hour for a ten-hour day. The owner reports that the sturdy, economical performance of the power plant—a 50 H. P. Model BTU—is a constant source of amazement to him.

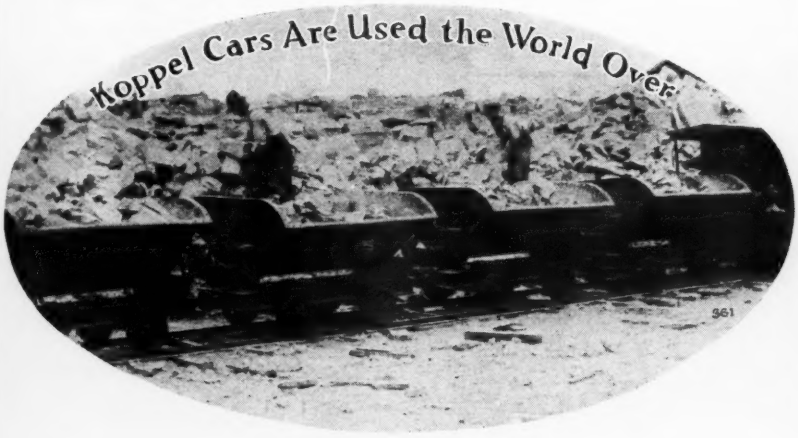
Such confidence in the Buda engine is almost traditional among contractors and plant operators everywhere. That's why so many leading manufacturers now specify Buda for their power. They know the battle is half over when their salesmen can say, "It's equipped with a Buda engine."

There's a Buda Power Plant for every industrial purpose—sizes from 20 to 83 H. P. Write for catalog and complete information

THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILL.
ESTABLISHED 1881

Buy only genuine Buda Parts for your Buda Engine

BUDA
The
ENGINE



Koppel Cars render this service because they are designed right and built right. They are the product of an organization with over 40 years experience in building and developing industrial railways of every description for every line of industry in all parts of the world.

There's a type of Koppel Car for every service—for contractors, road builders, quarrymen, sand and gravel operators, brick and clay manufacturers, industrial plants, coal and metal mines.

Cars shown above are at the Kelley Island Lime & Transport Company.

Get all the facts from our latest bulletin.

KOPPEL

KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.

Koppel, Penna.

RAILS SWITCHES FROGS TRACK

Sales Offices:

Pittsburgh New York Chicago San Francisco

KOPPEL

Two Waukesha "Ricardo Head" motor-driven Ingersoll-Rand Portable Compressors were used on this job.

Relieving Michigan Boulevard's "Jam"

Engineers of the Illinois Central Railroad faced the problem of providing safe passage for forty-two thousand commuters who daily cross Michigan Boulevard. They tunnelled the great thoroughfare at Van Buren Street—and for this work selected two I-R Compressors driven by Waukesha "Ricardo Head" Motors.

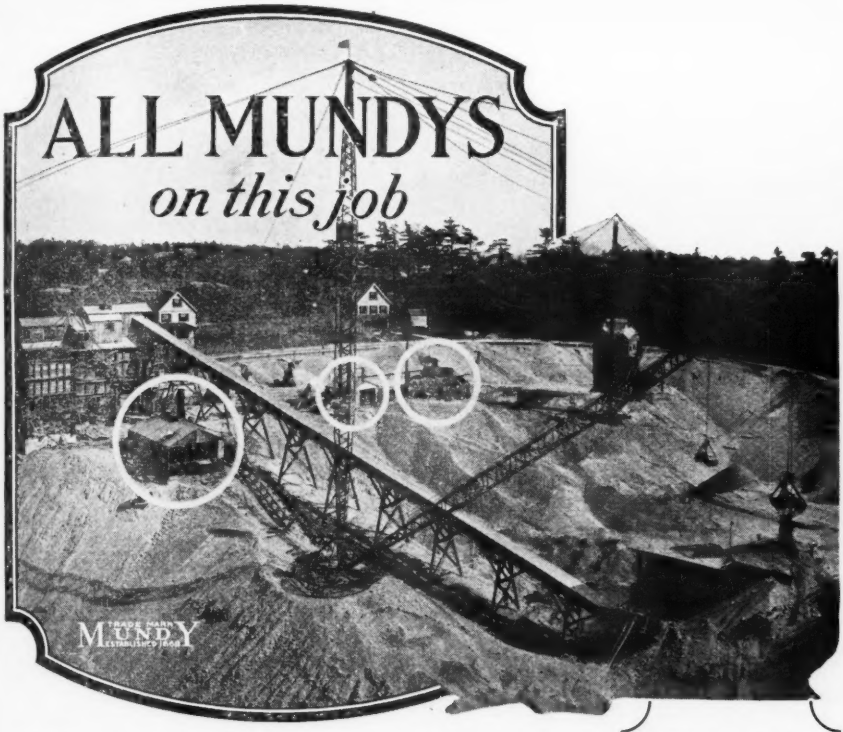
Where time is money it is folly to forget Waukesha "Ricardo Head" Industrial Power Units. If you need power, write for the new Waukesha Industrial Book.

WAUKESHA MOTOR COMPANY

Waukesha, Wisconsin

Eastern Sales Office *Aeolian Building, 33 W. 42nd Street* *New York City*

Exclusive Builders of Heavy Duty Gasoline Engines for Nearly Twenty Years



ONE of the largest guy derricks in New England is being operated continuously day and night by Mundy Hoists. A 10" x 13" three drum hoist moves 1000 yards of sand and gravel in eight hours with a two yard bucket, taking three yards at a bite. It requires only 45 seconds to make a round trip through a half circle swing.

Mundy Hoists are built to withstand the great abrasive action of the sand and gravel encountered in this kind of work.

A new 174 page book on Mundy Hoisting Equipment has been published. You can get your copy by dropping a card.

Plant of the Riverside Sand and Gravel Co., Newton Lower Falls, Massachusetts.

Chief Engineer, DeLorenzo says:—

"These Hoists are giving us the best of service under adverse conditions with practically no repair expense."

J. S. Mundy Hoisting Engine Company

Newark, New Jersey, U. S. A.

New York Sales and Export Office, 30 Church St.

Agents in principal cities

MUNDY HOISTS

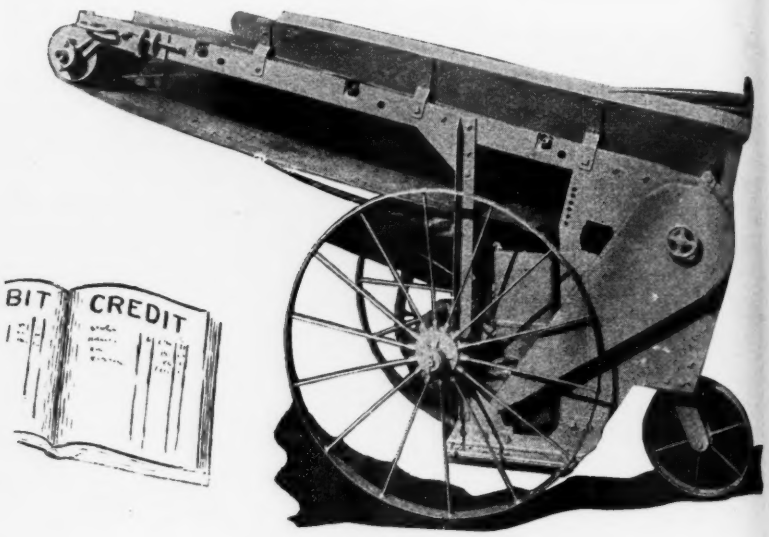


Figure loading saving as profits

With a gang of laborers to do your loading and unloading, you have a considerable handling charge to pay. That's reckoned in with your cost of production. But it comes out of your profits. With an Ottumwa Loader, your former handling charges would be added to your profits.

Easily proved savings result from the Ottumwa. It eliminates loading costs, prevents delays, increases capacity, and reduces costs. All of which means that your profits can be increased and your plant's efficiency, also.

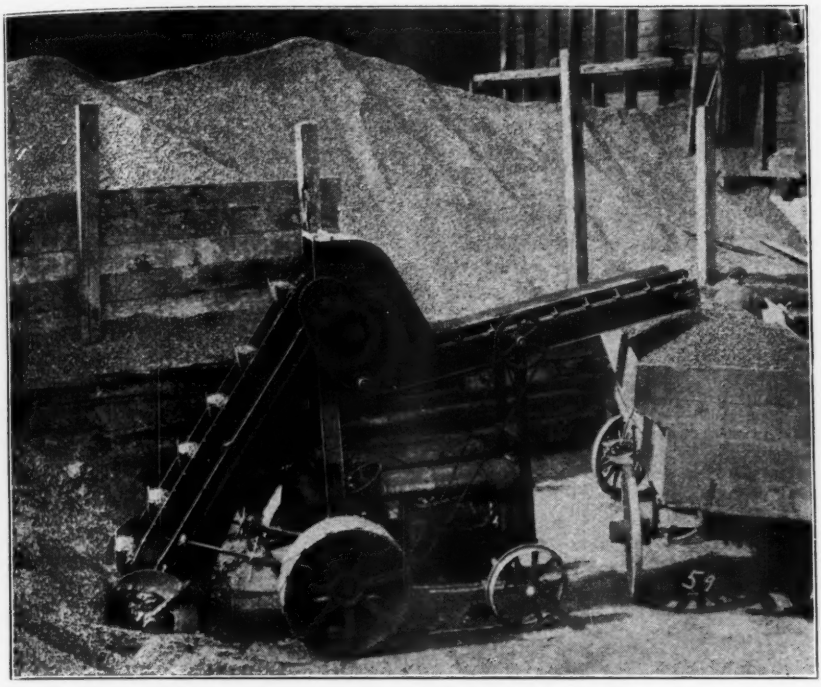
The Ottumwa will put dollars in your safe.

The Ottumwa Box Car Loader is manufactured with electric or gasoline power. It has roller or ball bearings throughout, and latest improved Alemite greasing system.

Full information and prices mailed on request.

OTTUMWA BOX CAR LOADER CO.

OTTUMWA, IOWA



An obvious proven aid to loading efficiency

Authentic figures indicate that many a plant can materially lower the cost of its loading operations. In actual experience Specialty Fordson Loaders made big cuts in this work in many installations.

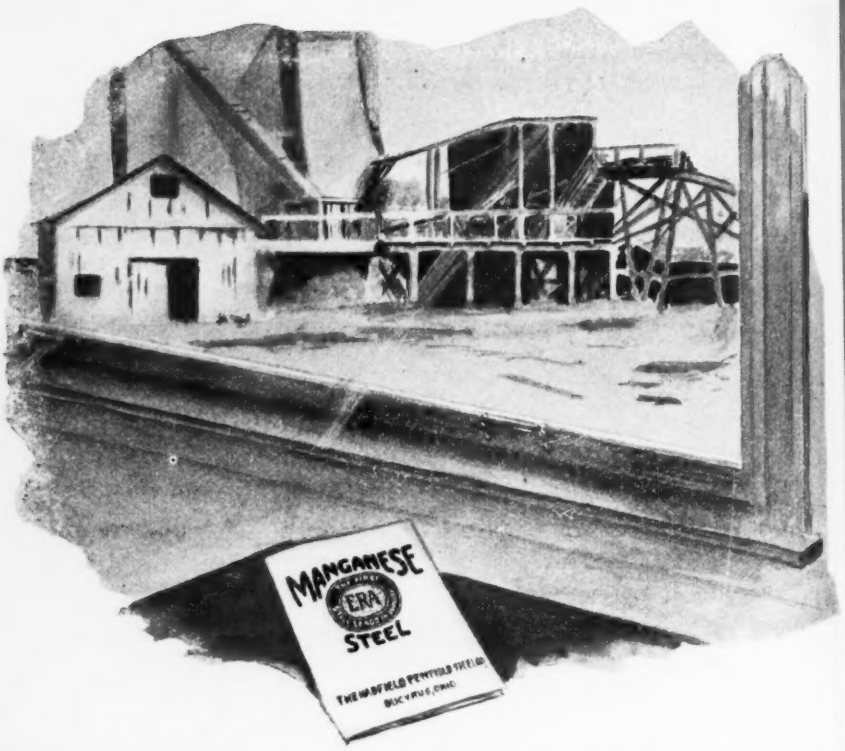
A Specialty Fordson Loader has all of the qualities that make minimum loading costs possible—speed, durability, self-feeding, crowding and digging. It is built scientifically correct and with a Fordson power unit, it means simplicity of operation, dependability, ease of installation and Ford Service.

One man, the operator, only is needed. He has full, easy control of the machine. He can crowd when buckets are in operation, independent of reverse gear. He may crowd the loader two inches or any distance—and he does the whole job of loading with ease, speed and economy.

You should know more about the big economy and advantages this efficient loader offers. Write for bulletins or see any Ford dealer.

SPECIALTY ENGINEERING CO.

Allegheny & Trenton Aves. **Philadelphia, Pa.**



This Bulletin May Save You Money!

There are only two good ways to increase profits—increasing volume or decreasing costs.

This bulletin tells you about "ERA" Repair Parts made of the toughest known steel. Repairs made of "ERA" Manganese Steel minimize the danger of mid-season delays, for "ERA" wearing parts stand up under abrasive wear as no other metal.

And as the season advances, and the going becomes harder, "ERA" Manganese Steel grows tougher, so that in each succeeding month's service the wear grows less.

Get your copy of the "ERA" Bulletin now and when you need repairs specify "ERA" Manganese Steel and insure long service for your equipment.

HADFIELD-PENFIELD STEEL CO.
Bucyrus, Ohio

MANGANESE STEEL
ERA
THE FIRST - STILL LEADS IN QUALITY

TELSMITH

Introduces a New Principle in Sand Tank Design—

IN this tank, the automatic discharge does not depend on the slight difference in weight between water and sand. As the sand builds up near the baffle plate, the water rises in compartment A. The accumulated sand helps to tip the tank; but it is this additional water that makes Telsmith really automatic, where other tanks are not.

The rapid adjustment of the water level assures a steady even "breathing" of the valve, which discharges the sand in small quantities but almost continuously. The deep sand bed is left undisturbed, preventing sudden gushes of dirty water into the bins. These are not mere *claims*. We *guarantee* this tank to work automatically all day and every day, without any attention, dewatering within 22-25 per cent, and passing only 5 to 8 per cent free water into the bins. May we send you Bulletin S-T-15. No obligation.

SMITH ENGINEERING WORKS

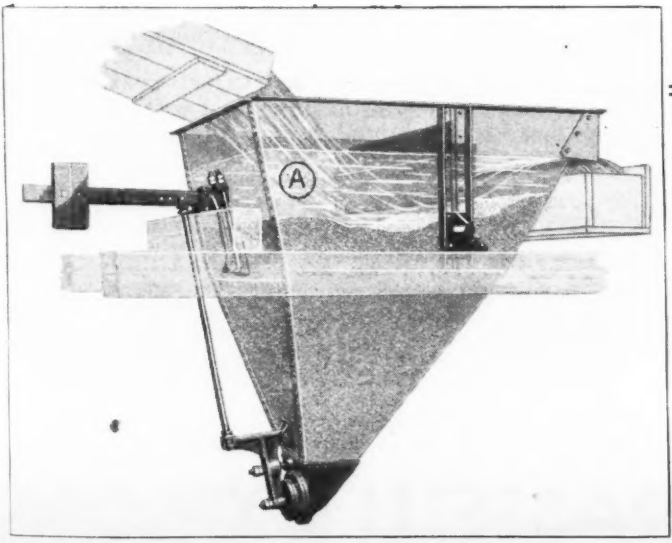
3183 LOCUST ST. MILWAUKEE, WIS.

Old Colony Bldg., Chicago, Ill.

18 East 41st St., New York City

Waldo Bros. & Bond Co., Boston, Mass.

Beckwith Mchy. Co., Pittsburgh and Cleveland



Let Grasselli Help You

WHATEVER your blasting problem may be a Grasselli Service Man can help you solve it. Whether it is the lay of the rock, the texture, the waste or the wrong explosive—you will find his advice helpful in getting bigger production at lower cost.

Grasselli Service Men are men who have had years of experience with explosives in many different quarries. They know Grasselli Explosives and can tell you just the grade you need to overcome conditions in your quarry.

We'll gladly send a man to your quarry whenever you want him. Just write our nearest office and ask for him. His services are yours without obligation.

THE GRASSELLI POWDER COMPANY

Main Office: Cleveland, Ohio

Branches:
Philadelphia
Bluefield, W. Va.
Birmingham
Wilkes-Barre, Pa.
Brownsville, Pa.

Manufacturers of CHEMICALS ZINC GRASSELLI EXPLOSIVES DYESTUFFS

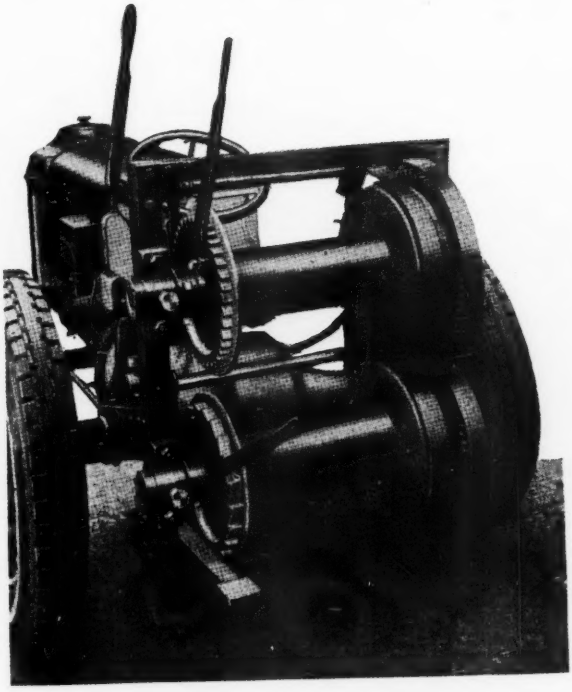
Pittsburgh
Chicago
Clarksburg, W. Va.
Pottsville, Pa.
Hazleton, Pa.
New Castle, Pa.

The Grasselli Powder Co., of Florida, Miami, Florida

GRASSELLI EXPLOSIVES

The Ideal Power Hoisting Unit

Continental Winches



Trouble-Proof Hoisting Power

CONTINENTAL Winches are made in two types—friction drive and gear drive, and two sizes—single and double drum.

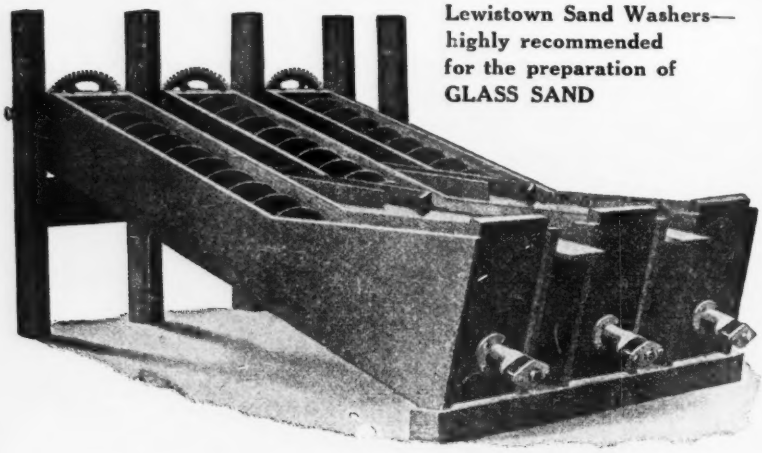
The friction type is used extensively for loading logs, heavy timbers, and any other heavy objects that require careful handling or speedy operation. It is especially adapted for dragline scrapers, and when mounted on the Fordson Tractor, it makes a most complete, and economical unit.

The powerful brakes which control the drums are operated with convenient foot levers, excepting the top drum on the double drum type, which is operated by hand. Each drum is equipped with ratchet and pawl, so that the load may be held in suspension without using the brake. Speed ranges from 60 to 200 ft. per minute on all lines.

Every Continental Winch is unconditionally guaranteed against defective workmanship and materials. Defective parts replaced F. O. B. Memphis without charge.

SPINKS SUPPLY CO.

MEMPHIS, TENN.



Lewistown Sand Washers—highly recommended for the preparation of GLASS SAND

IS YOUR PROBLEM LISTED HERE?

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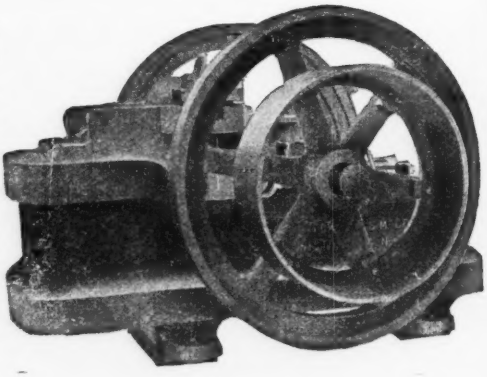

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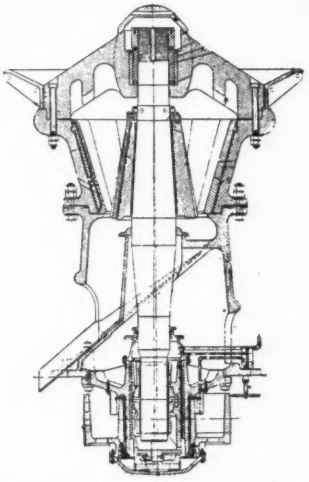

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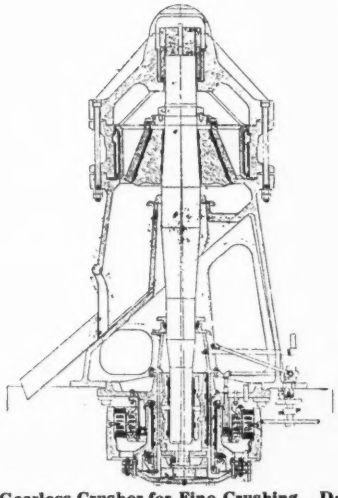

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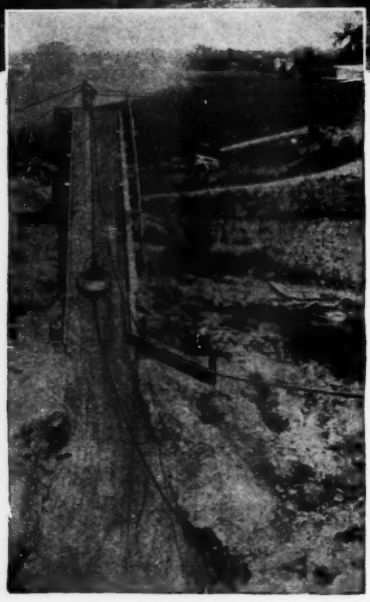

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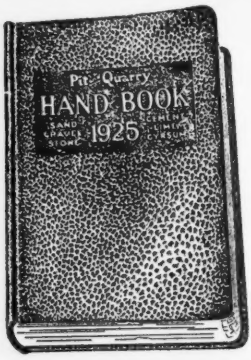

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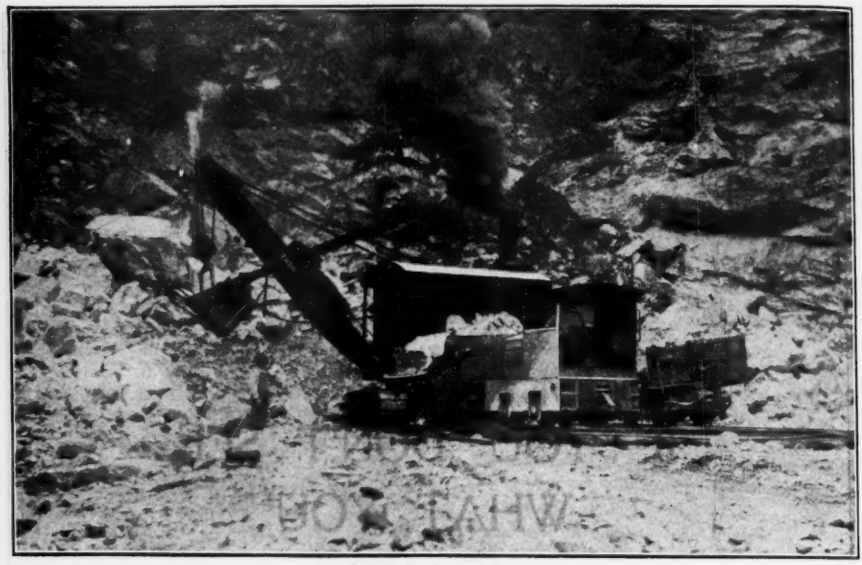

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A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metalic Minerals.

VOL. 10 | CHICAGO, ILL., JULY 15, 1925 | No. 8

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BYERS BEAR CAT

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Pit and Quarry

Vol. 10 Chicago, Ill. July 15, 1925 No 8.

Pros and Cons of Profit Sharing

DURING the last quarter of the nineteenth century profit sharing as a solution of many phases of the labor problem occupy the attention of philanthropists and social reformers. Successful operation of profit sharing plans in England and France led idealists in this country to turn to the subject with great eagerness. Most of the schemes introduced were soon discontinued, however, owing to a lack of enthusiasm both on the part of the employer and of the employee. A reviving interest in the subject during recent years, and the fact that a number of firms have been giving the system a trial, justify a consideration of profit sharing in the light of present-day business practice.

Profit sharing is an arrangement whereby any portion of the employees' remuneration varies directly with the net profits of the business, or any part or unit of the business. While there are varied forms of profit sharing, the fundamental principle is that the amount of the special payments received by employees shall be directly contingent upon the earnings for a specified period, and shall vary directly with those earnings on a prearranged basis. The usual form of the plan involves a distribution of a portion of the profits of the business as a whole, but there are many variations of the theory. The essential feature is that the employees' earnings are not definitely fixed and that they vary in relation to the net profits. The payment of a periodic bonus, consisting of a certain percentage of wages and having no relation to the profits earned during the specified period, is not what is meant by profit sharing, even when the amount of the bonus depends somewhat upon the prosperity of the business during the period under consideration.

One of the arguments in favor of profit sharing is that it will increase the efficiency of the employee. It is contended that his capacity for production will increase if he is aware that he will receive a portion of the year's profit and that he can be instrumental in increasing the year's earnings. On the other hand opponents of the idea maintain that profit sharing is in reality only an indirect stimulus to increase effort since the productiveness of all the employees is necessary in order to have an appreciable effect upon the year's output. When individual effort can be measured, it is considered more effective to use some basis of pay which rests upon measurable individual output. Only when men work in groups or gangs can the results of the work be measured as a joint product.

Some of the specific points in the contention that the employee who shares in the profits will put forth greater effort in making them may be of interest. Such an employee is careful of machinery and uses every effort to prevent delays and repairs. He is careful in the use of oil, small tools, and supplies. He prevents material from being wasted. He is careful that material for which he is responsible conforms to specifications. He becomes more orderly and more expert. He is interested in the process with which he is concerned and alert to find methods for improving his own unit and for increasing his own skill. Such a workman, of course, thinks as well as acts, and is as valuable in preventing loss as he is in increasing output. If profit sharing were certain to accomplish this, there would be no argument regarding its value. It would then be instrumental in demonstrating the difference between production and profitable production.

A convincing argument against the theory of profit sharing is its uncertainty and its demoralizing effect on the employees. Uncertainty, always a disturbing factor, is unavoidable. Uncertainty as to whether there will be profits each year; un-

certainty as to what they will be; uncertainty as to whether the true profits are being revealed; these are some of the elements that interfere with the harmonious working of a profit sharing scheme in many plants. If employees have been receiving the profit sharing bonus year after year and a sudden period of depression comes, the result is likely to be a general feeling of disappointment and unrest. It is difficult to adjust a financial program to sudden loss, and this is true with the lowest paid workman as well as with the manager of the plant. The success of the idea, therefore, depends upon the continued prosperity of the business or upon the personality of the owner who retains the loyal cooperation of his men through the ups and downs of business hazard.

The relation of profit sharing to labor turnover is used as an argument in its favor. There is, of course, no question that a large labor turnover eats into profits and that any device that will cut it down is worthy serious consideration. Various modifications in the details of profit sharing plans are made with the aim of promoting length of service. In some cases the plan stipulates that employees may not become participants until they have served a specified period, usually one year, sometimes as long as five years. In rare cases it has been provided that the share of profits paid to the employee shall increase in proportion to his length of service. The obvious intention is to exclude casual workers from participation in the profits and to induce good workers to become permanent members of the force. Practically all firms that operate on a profit sharing basis are of the opinion that the length of service of their employees has been promoted under the system.

The main hope of the advocates of profit sharing has been that it will promote industrial peace. They believe that by making the interests of the employer and the employee identical, antagonism and friction will be eliminated and harmony will prevail. While this aim is commendable and the goal highly desirable, there exists considerable doubt as to the possibility of such an outcome. Among the employees themselves there is a tendency to regard profit sharing as a clever device on the part of the employer to secure industrial peace at the expense of the employees. Labor leaders have expressed the opinion emphatically that the principle of profit sharing is not advantageous to the laborer; that it tends to speed up the worker abnormally; and that a fair, steady wage for a fair day's work is more desirable. Many employers who have tried out the plan have abandoned it as unsatisfactory. Their chief objection lies in the uncertainty of the year's profits and the feeling of dissatisfaction on the part of the employee if he suffers because of a poor year's returns.

It is certain that the question of profit sharing is debatable. It is generally agreed that, to be effective, it must begin with the payment of the regularly established market wages or salaries. The payments must be substantial and must be made in accordance with a definite plan. From the standpoint of the management it has many weak points. From the standpoint of labor it has received the unfavorable comment of conspicuous leaders. Its advocates, on the other hand, are convinced that the principle is fundamentally sound and that it will in time solve many of the delicate and crucial problems of capital and labor.

Sensing the Right Moment

MEMBERSHIP in the National Crushed Stone Association can be recommended to any and all crushed stone producers. This organization at the present time is composed of a very representative growth of progressive crushed stone producers each preserving his individuality and applying local knowledge to local needs but all federated into a single cohesive union in order that national universal service may be provided.

What probably is the right moment for developing a larger association appears to be present. The recent decision of the Suprme Court assures freedom of action in many association activities which had to be abandoned previously.

The present officers of the Association under the leadership of Mr. Otto M. Graves are capable of uniting the producers into something more powerful which the industry needs. The most successful business generalship is in sensing the right moment.

New Method of Storing and Reclaiming Sand Gravel and Stone

United Fuel And Supply Company Will Build Efficient Plant Utilizing New Methods Allowing Live Storage of 135,000 Tons

WHAT WILL probably be the largest storing and reclaiming installation for the distribution of these products by truck to the consumer is under construction at the Atwater Street Dock and Yard of the United Fuel and Supply Company in Detroit.

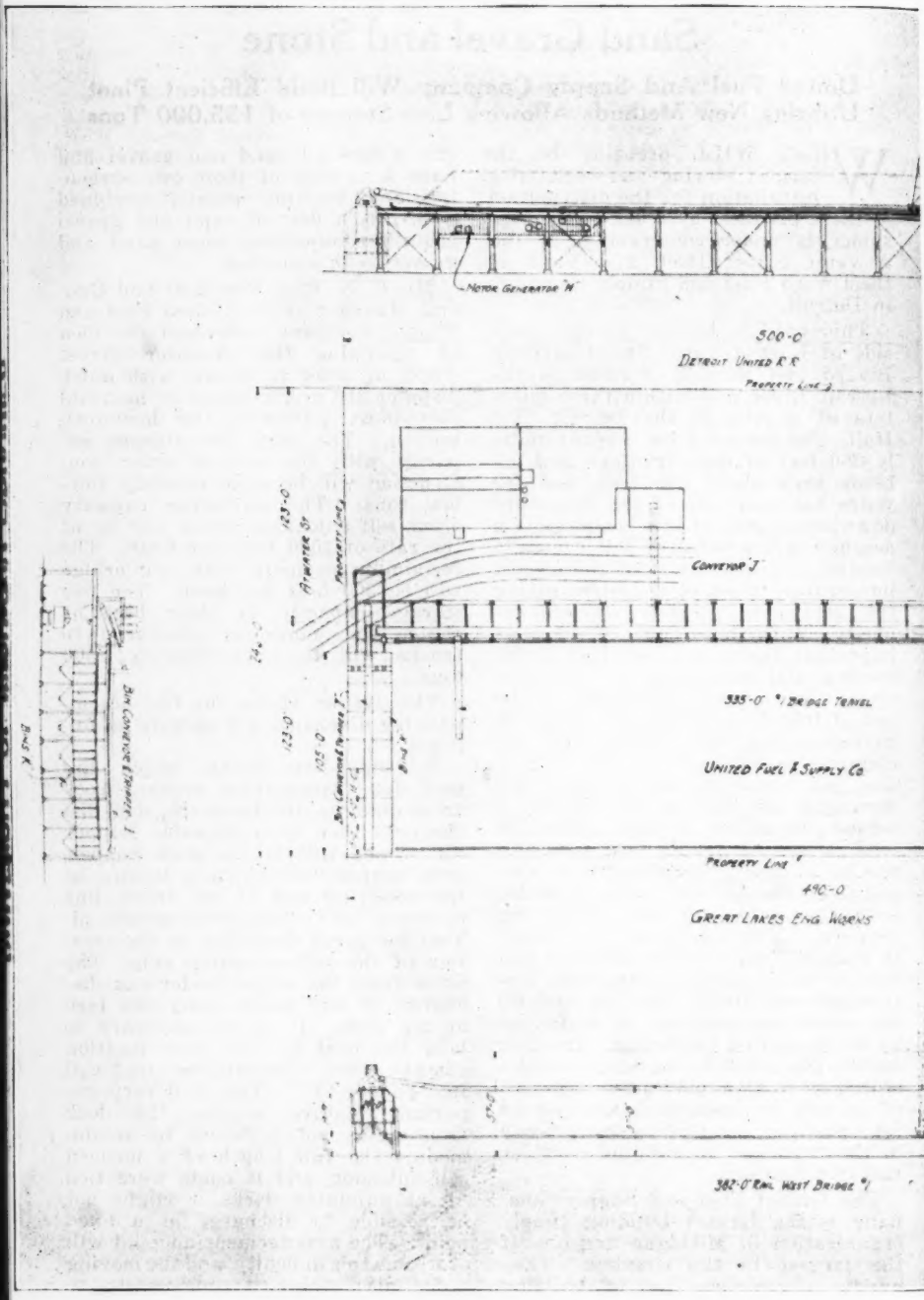
This yard is located on the south side of East Atwater Street between Rivard and Riopelle Streets on the Detroit River and within three quarters of a mile of the Detroit City Hall. The property has approximately 250 feet of dock frontage and extends back about 500 feet, and for years has been one of the important downtown yards of this company. On account of the value of this centrally located property it was of the utmost importance to adopt a system giving the maximum possible storage capacity. With this as one of the most important features a new idea in the storing and reclaiming of this material has been developed. The use of traveling bridge with stacking conveyors for both storing and reclaiming in conjunction with a trunk line belt conveyor was adopted and arranged, so that in the future a second traveling bridge, combined with a second trunk line conveyor, can be installed. This makes it simple, when the demand comes, to double both the unloading and reclaiming capacity. This also makes it possible to reclaim different size material and mix at will. Another important feature presents itself; the fact that all the stored material can be reclaimed by the bucket on the bridge. In other words, there will be no dead material stored on this valuable property. All of it can be reclaimed and placed into position for loading by gravity to the trucks or to railroad cars for rail distribution.

The United Fuel and Supply Company is the largest building supply organization in Michigan and one of the largest in the country. They handle a complete line of building supplies and in the City of Detroit operate 12 yards. They are producers of washed sand and gravel and have a number of their own screening and washing plants, combined with this a fleet of sand and gravel boats for supplying river sand and gravel to this market.

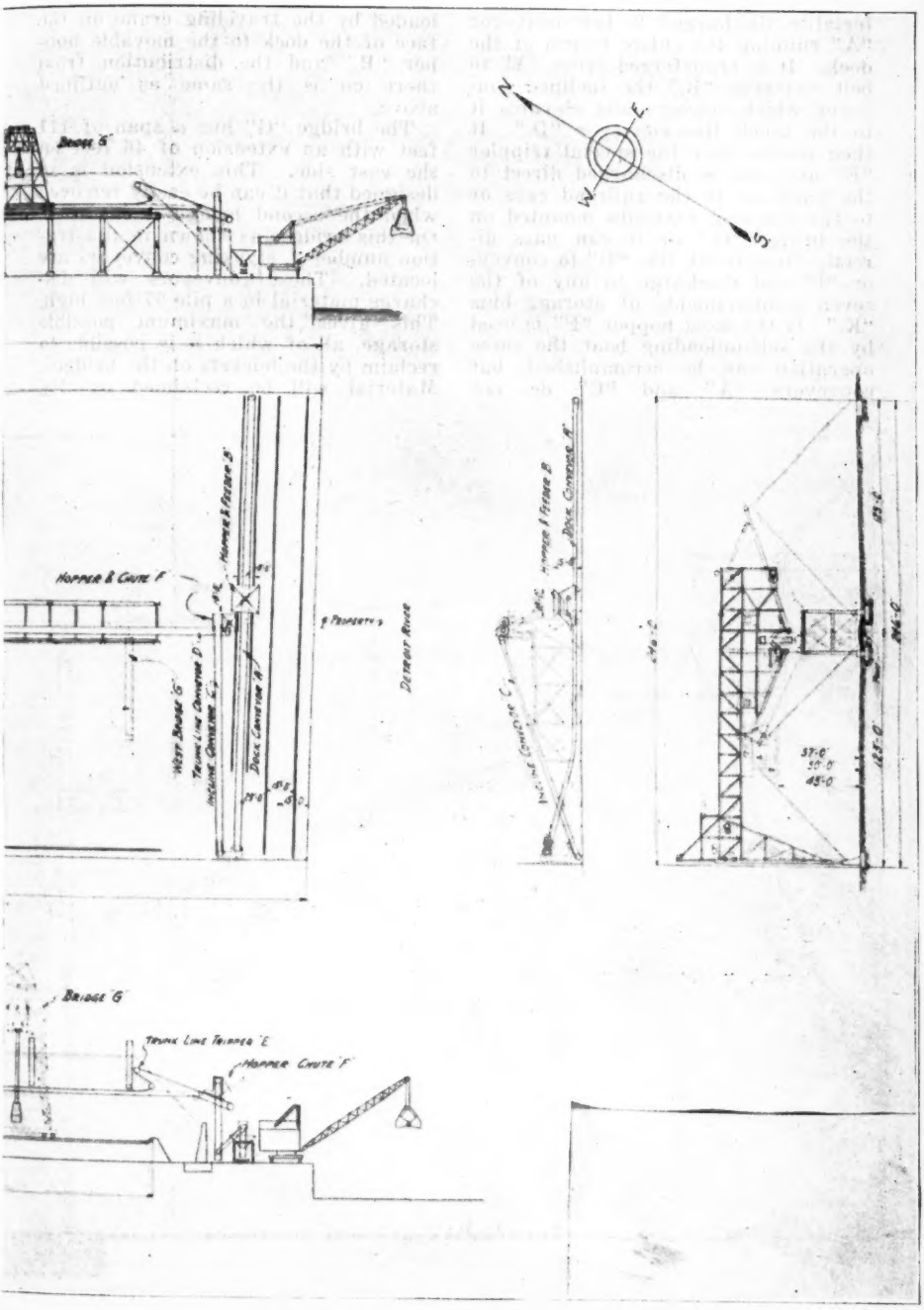
Mr. C. N. Ray, President and General Manager of the United Fuel and Supply Company, conceived the idea of equipping this Atwater Street Yard, in order to handle with quick dispatch the great volume of material they must deliver to the downtown section. The total live storage capacity with the system under construction will be approximately 135,000 tons. The unloading capacity from self-unloading ships will be at the rate of 1500 tons per hour. The reclaiming capacity with one bridge will be 300 tons per hour. The live storage capacity in their bins or chutes for immediate discharge to trucks will be approximately 2500 tons.

The system shown in the accompanying diagrams will operate as follows:

Self-unloading boats, which are used for transporting crushed rock from quarries in the north, can discharge either to a movable hopper "B" which will be the dock hopper, or a hopper "F" which is located at the receiving end of the trunk line conveyor "D." This arrangement allows for great flexibility in the location of the self-unloading ship. The boom from the self-unloader can discharge at any point along the face of the dock. It is not necessary to hold the boat to any fixed location except when discharging material into hopper "F." This is a very important feature because the dock frontage is not sufficient to accommodate the full length of a modern self-unloader, and if boats were tied up at adjoining docks it might not be possible to discharge at a fixed point. The arrangement adopted will overcome this difficulty, and the moving crane also makes it unnecessary to move a non self-unloader to get from hatch to hatch. From the moving



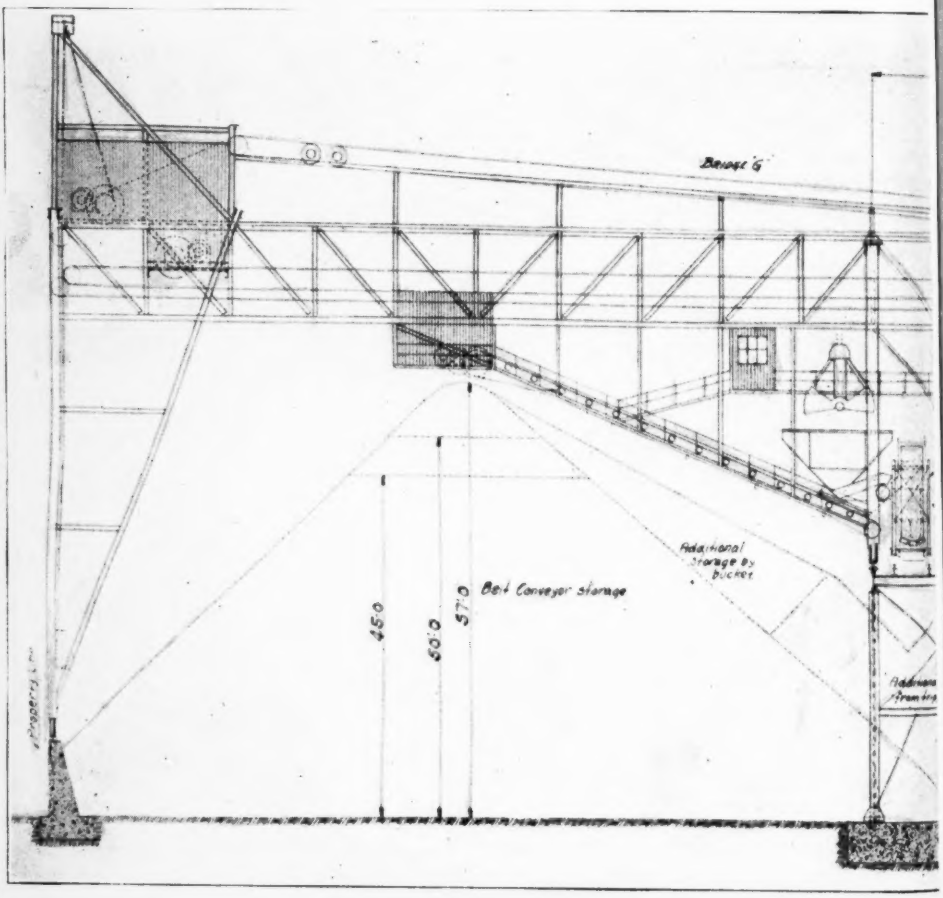
Arrangement of Dock As Adopted



By the United Fuel and Supply Company

hopper "B," which is equipped with a belt type power-driven feeder, material is discharged to belt conveyor "A" running the entire length of the dock. It is transferred from "A" to belt conveyor "B," the inclined conveyor which conveys and elevates it to the truck line conveyor "D." It then passes over the special trippler "E" and can be discharged direct to the yard, or to the railroad cars or to the stacking coveyors mounted on the bridge "G," or it can pass directly from trunk line "D" to conveyor "I" and discharge to any of the seven compartments of storage bins "K." If the fixed hopper "F" is used by the self-unloading boat the same operation can be accomplished, but conveyors "A" and "C" do not operate. When non self-unloading boats are handled all material is unloaded by the traveling crane on the face of the dock to the movable hopper "B," and the distribution from there on is the same as outlined above.

The bridge "G" has a span of 111 feet with an extension of 46 feet on the east side. This extension is so designed that it can be easily removed when the second bridge is installed. On this bridge, as shown in illustration number 2, stacking conveyors are located. These conveyors will discharge material in a pile 57 feet high. This gives the maximum possible storage, all of which it is possible to reclaim by the buckets on the bridges. Material will be reclaimed by 2½

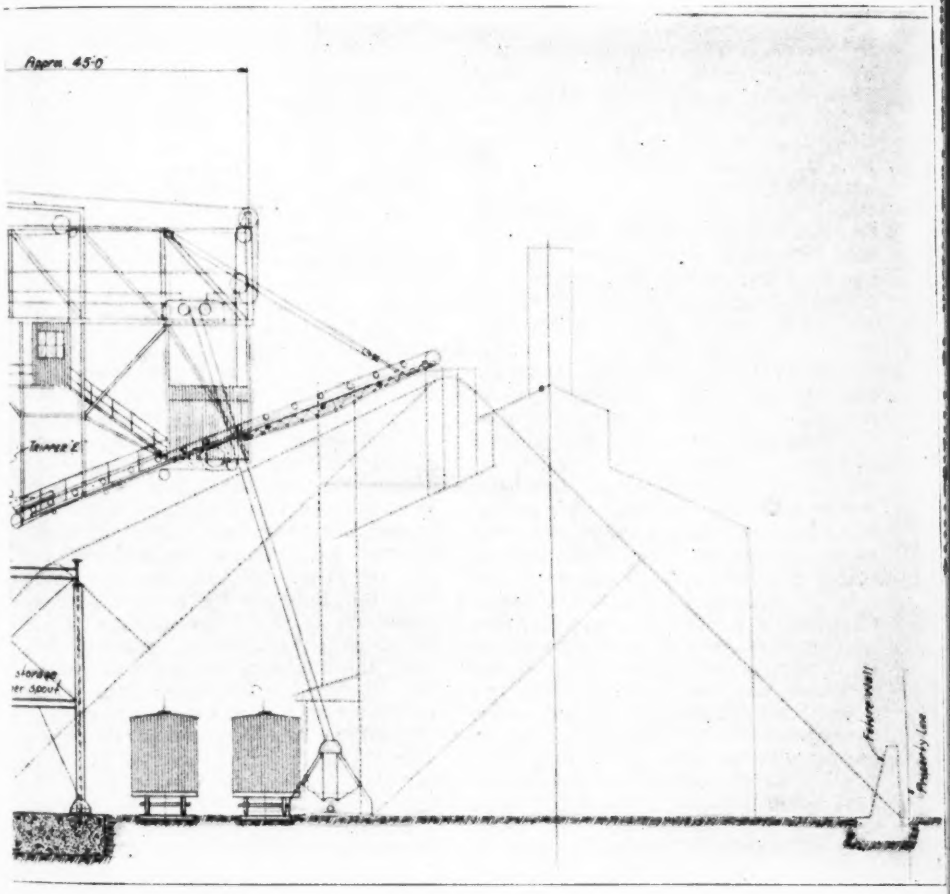


Elevation of Bridge as Adopted By

yard buckets from any point under the bridge and delivered through a hopper and feeder mounted on the bridge to the trunk line belt conveyor "D," and from this conveyor either to any one of seven bins or chutes by belt conveyors "D" and "I" or direct to railroad cars or by belt conveyor "J" to the plaster mill sand bin.

The storage bins or chutes located along Atwater Street will be approximately 100 feet long, 24 feet wide and 31 feet high, and have a live capacity of 2500 tons. They will be divided into seven compartments. These hopper bottom bins will be equipped with special gates operating in series so that movement of the truck, in order to trim the load, will not be necessary. Trucks will drive in from Atwater Street to any of the seven compartments and will back out on being loaded. It is possible to load seven trucks at one time without any traffic congestion under the chutes.

The system was designed and is being constructed in the shops of the Stephens - Adamson Manufacturing Company at Aurora, Illinois. The United Fuel and Supply Company are constructing an entirely new reinforced concrete dock, and all foundations to support the structure which will be of steel. All conveyors used will be belt type, each conveyor independently driven by electric motor. Primary current will be brought to



The United Fuel and Supply Company

the dock from the Edison power lines and will be transformed to proper voltage. Motor generator sets will be installed for the operation of the bridges. In all, approximately 430 H.P. of motors will be required to operate the system.

The United Fuel and Supply Company will arrange to completely fill this storage at the close of navigation each year, and from this supply will be able to distribute sand, gravel and broken stone to their customers throughout the Winter months.

An Important Transaction in the Soapstone Industry

SEVERAL months of negotiations were concluded recently when papers were signed and approved by counsel for the concerns interested. The transactions cover the taking over by the Armstrong Products Corporation, 42 Broadway, New York, of the Phoenix Soapstone Company, the Maryland Soapstone Company and the Virginia Chesapeake Soapstone Corporation, and as an added facility the absorbing corporation also acquired a railroad which supplies interconnecting quarry transportation and connects with the Southern Railway.

The Armstrong Products Corporation through these acquisitions will not only have a sufficient quantity of merchantable soapstone that should last for a hundred years or more, but will have transportation facilities, important trade names, etc., which have been before the public for over twenty years as have the products supplied to users of soapstone.

The Phoenix and the Virginia Chesapeake Soapstone Companies are located near Arrington, Nelson County, Virginia, on the main line of the Southern Railway, and the Maryland Soapstone Company is located about twenty-five miles from Baltimore on the main freight line of the Baltimore & Ohio R. R. All these companies have been and are in operation, and through this absorption the Armstrong Products Corporation expects to enlarge the capacity of each plant in order to meet the demand for soapstone and its products which is constantly increasing in volume.

The Maryland Soapstone Company will continue to manufacture pulverized soapstone, or talc, for local as well as export purposes. The Phoenix and Virginia Chesapeake plants are to continue in the quarrying of blocks, slabs and sundry items which will in turn be fabricated by them into items ready for its users.

In view of the fact that it is said the only soapstone deposits of any considerable quantity, so far known are situated in the region where these properties are located, and there is only one other concern of magnitude in this business, it is not difficult to understand that with the existing market for soapstone products, whoever is engaged in its manufacture on a large scale, with an ample supply of stone, should enjoy a most profitable career.

The management and direction of the Armstrong Products Corporation will be in charge of the following: Mr. William P. Benjamin, President, Director and Engineer in Charge, is a consulting Civil Engineer of New York, and Associate Member of The American Society of Civil Engineers, and was formerly connected with the Sinclair Consolidated Oil Co., the Aetna Chemical Co., Babcock & Wilcox Co., and Civil Engineer Eng. Corps, U. S. Army, attached to the staff of Col. W. M. Black, who was chief of the Engineering Corps of the U. S. Army, during the World War. Mr. Thomas H. Armstrong, Vice President, Director and Manager of Plants, has had more than 25 years' experience in the Soapstone industry, having been formerly connected with Arrington Soapstone Co., in the capacity of President and Manager and with the Robinson Stoneware Co., a subsidiary of the Alberene Stone Co., in which connection he successfully filled the office of manager of sales. Mr. Oscar M. Gerstung, Secretary, Treasurer and Director, is an executive officer and director of the Sinclair Oil Co. Mr. William A. Maltus, Director, is the senior partner of the firm of Maltus & Ware, one of the most reputable U. S. Customs Brokerage firms in the country. Mr. Will T. Snyder, Director, Attorney at Law, Arrington, Va., Director and Secretary, Wells Holland Motor Co., President Snyder and Co.

Pit and Quarry Transportation Methods

By G. B. MASSEY

TRANSPORTATION of material involves three distinct processes, all of which have to be considered in arriving at an intelligent conclusion as to the most economical way to pick material up, move it to a new location and deposit it. These three steps in quarry or pit work are loading, hauling and dumping. The loading is usually done by a machine specially designed for the purpose but there are exceptions which are mentioned later.

Transporting of overburden or sand can be done by slip scrapers, wheeled scrapers, self-loading scrapers, two-wheeled carts, four-wheeled dump wagons, trucks, narrow gauge cars, standard gauge cars, water, and belt conveyors. For short distances the slip scrapers, wheeled scrapers, self-loading scrapers and two-wheeled carts are best. For middle distances, self-loading scrapers, four-wheel dump wagons and narrow gauge cars. For long distances, trucks, standard gauge cars, water and belt conveyors.

So the first consideration in deciding on the method of transportation is the length of travel. The second is whether the haul for loads is up grade or down grade or on a level. If the load haul is a very steep up grade, the means of transportation are limited to elevators, cars on inclines, or water. The third consideration is the nature and size of the material; the fourth is the manner of excavating and loading and whether there is one loading and one dumping point or more than one.

There are several axioms which apply:

1. Only one type of transportation should be used if it is possible. In other words, once material is loaded, it should be carried through to destination.

2. The more automatic a system is, the less labor is required and the lower the total cost.

3. Operators of quarries and sand pits can and should give very careful study to their own transportation problem. They should look to the permanent installation of the most economical equipment instead of blindly adopting the transportation methods in general use on temporary contracting jobs, where loading points and dumping points are constantly changing and the life of the job is short.

4. If locomotives and cars are used, they should be made up in trains and operated so, instead of making up and uncoupling every trip.

5. Most transportation systems show higher costs than they should because too little attention and money are applied to upkeep of equipment.

6. It is seldom that transportation equipment is sufficient to keep the loading machine working at its most economical speed. The writer has in mind one case where the output was increased two hundred percent with no change whatever in the loading machine.

The relative costs per cubic yard carried one hundred feet are:

	Cents
No. 2 slip scraper	24
No. 1 slip scraper	16
No. 2 wheeled scraper	8
No. 3 wheeled scraper	5
Two-wheeled carts	2½
Tractor & Maney scrapers	2½
Wagons, 1½ yd.	1¼
Trucks	4-10
R. R. track and gas locos.	1-4
Water in pipe	1-6
Electric haulage	1-8
Belt conveyor	1-10

In the above comparison, the slip scraper, wheel scraper, cart, Maney scraper and water are assumed to be handling earth. In the case of wagons, trucks, locomotives and electric haulage, the equipment is suitable also in varying degrees for rock as loaded by the loading machine. In the case of the belt conveyor, it can handle rock after it has been crushed to a uniform maximum size.

The belt conveyor is the most economical method of handling large tonnages of small sized material through the distances usually requiring to be covered in pit and quarry operations. The loading point is usually fixed and the dumping point may be variable along the line of

Vice-President, Randolph Perkins Company
Associate Editor, Pit and Quarry

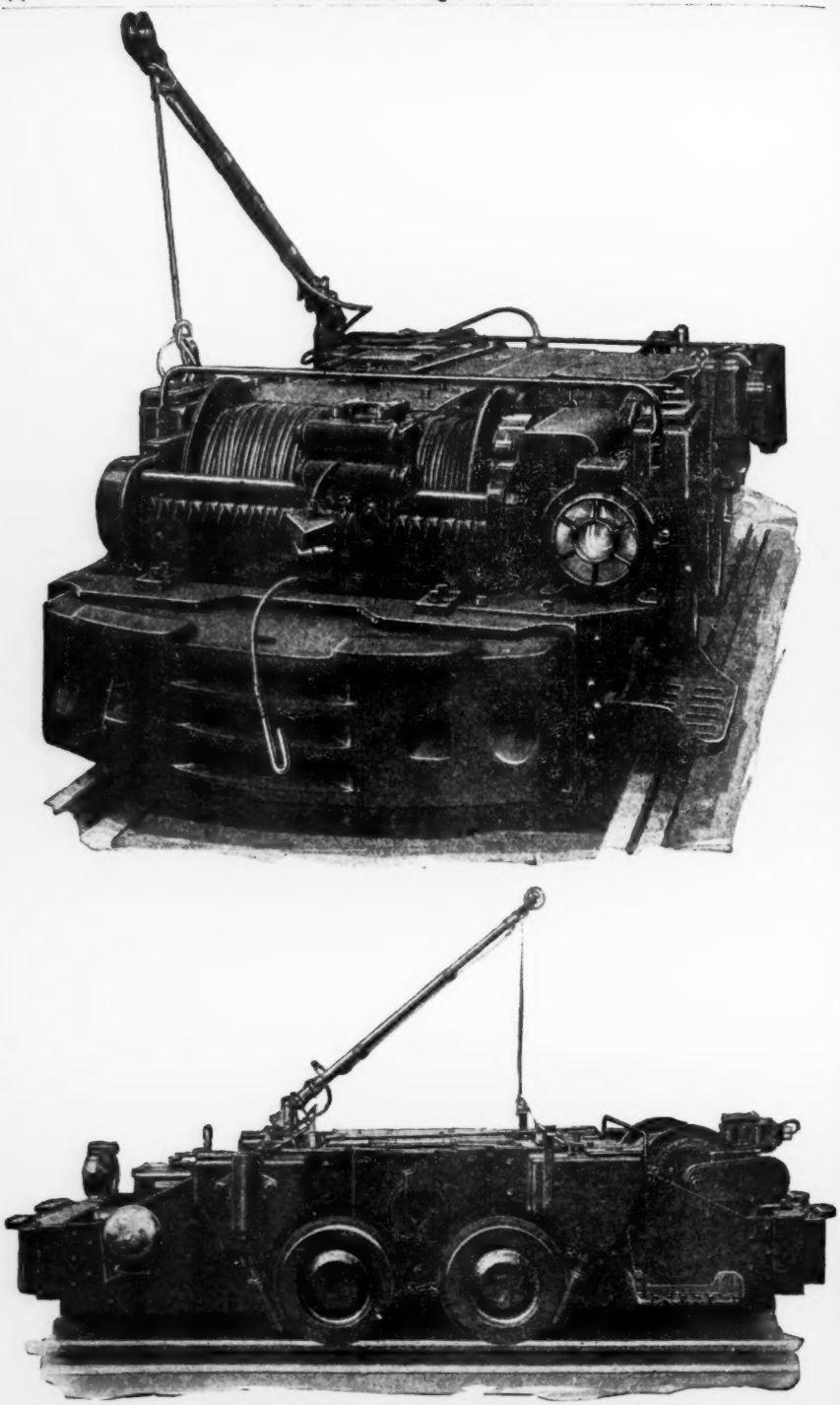


Illustration of Electric Locomotives

the conveyor. This makes it available for handling and storing material after it has been loaded and collected at one point, or it can be used between two operations.

Quarry cars are in general of two types, one with vertical sides and with one or two doors so as to dump on one or both sides, and the other the rocker type of car with sloping sides and no doors. The former can usually be dumped and righted by hand if necessary while the latter is arranged to dump by power only. The best cars for rock are those with full steel frame and heavy wooden body. If a steel dump sheet is applied to the wooden floor, the car will stand the maximum amount of punishment with the minimum of deterioration in the running gear and frame of the car.

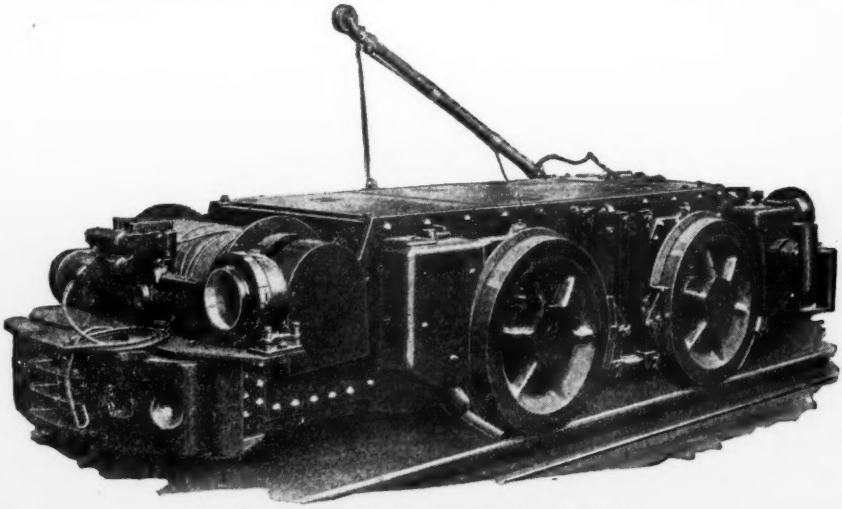
More gasoline locomotives are being used now. There are several advantages over steam locomotives. In addition to using more easily handled fuel and very little water, there is no stand-by loss and the various speeds may be used at will so as to obtain the maximum power at the slowest speed.

With steam locomotives the maximum horse power developed is cut down by the slow speed of the pistons. Of course geared steam locomotives are available, but the speed on the level is low.

Gasoline engines are built with all roller chain drive and combination of gear and roller chain reductions. Usually the last reduction is by roller chain. Brakes are applied either to the wheels as usual or to the drive shaft, the latter being the logical place. Where speed change gears are used, it is best to have the gears always in mesh and equipped with jaw clutches instead of the sliding gear type.

The ideal locomotive, which is not yet available, will be driven by a multi-cylinder vertical heavy oil engine starting by air and driving, direct if possible, a hydraulic speed change unit which will be mounted with the pump on the engine shaft and the motor-part on a cross-shaft, with roller chains, to both axles. This will mean the maximum economy as to fuel and the maximum flexibility, as any speed can be had from maximum in one direction to maximum in the other direction without gears or clutches. The weight of the machinery is no objection as weight is necessary for traction. No brakes will be necessary. The first cost will be high, but the operating cost will offset this in a reasonable period.

Electric locomotives are used to some extent in quarries and pits. They can be had arranged for third rail, trolley or storage battery. They can also be had to operate on third rail or battery and on trolley or battery. The most suitable combination is an electric locomotive with a trolley and also a reel carrying a double



An Electric Locomotive Equipped with Trolley

cable, one wire of which can be hooked to the trolley line and the other clamped to the rail.

When the locomotive is on permanent tracks, the trolley is used, but when running over the tracks which have to be moved and are in the blasting area, the reel is used, enabling the locomotive to run a thousand feet beyond the end of the trolley wire. The reel is revolved by power and the track is not used as a conductor, so that it does not need to be any better than such track usually is.

The reel is suitable where the train runs out and back over the same track. Where there is a run around, the combination of trolley and storage battery is more suitable. The upkeep on these locomotives is extremely low. In order to exert the greatest tractive effort on a slippery rail, all driving wheels should be connected, as they are in a steam locomotive, so that all slip or none.

Although various tractive efforts are attributed to different locomotives, it is not practicable to count on more than 25 per cent of the weight of the engine on the driving wheels as available draw-bar pull. The figures for tractive effort to move cars vary from 15 to 80 pounds per ton of weight. The latter figure takes care of poor light rails, the average run of cars and the grades usually negotiated on contract jobs. Forty pounds is the average.

Another type of electric haulage has each car equipped with one or two motors, and all cars are handled by one operator. A third rail is used and the track has to be bonded. The first cost of this equipment is high but the operating costs are low.

The best arrangement for the usual quarry is to have the primary crusher low enough so that cars can be run direct from the loading machine to the primary crusher without excessive grades. The rock as crushed by the primary crusher is elevated to the screens and secondary crushers by bucket elevators thus doing away with the labor and delays experienced in switching, uncoupling and coupling up.

John P. Case has been appointed general manager of sales for the Brown Hoisting Machinery Co., Cleveland, manufacturer of automatic hoisting and conveying equipment, to succeed E. C. Pierce, resigned.

Freight Car Loadings

Loadings of revenue freight for the week ending on June 27, totaled 991,341 cars, according to reports filed by the carriers with the car service division of the American Railway Association.

Compared with the corresponding week last year, this was an increase of 83,090 cars, but a decrease of 30,130 cars under the corresponding week in 1923. The total for the week of June 27 was an increase of 8,741 cars over the preceding week, grain and grain products, live stock, coal, miscellaneous freight and ore being the only commodities to show all increase over the week before.

Loading of merchandise and less than carload lot freight amounted to 255,807 cars, a decrease of 1,907 cars under the week before, but 15,715 cars above the corresponding week last year as well and 10,699 cars over the same week two years ago.

Miscellaneous freight loadings totaled 369,057 cars, an increase of 1,564 cars above the week before and 45,858 cars above the same week last year. It also was an increase of 20,166 cars above the same week two years ago.

A comparison by weeks follow:

	1925	1924	1923
June 27	991,341	908,251	1,021,471
June 20	982,600	803,546	1,005,432
June 13	987,106	902,592	1,008,838
June 6	994,874	910,793	1,012,312
May 30	920,514	986,209	820,551
May 23	986,209	918,214	1,015,532
May 16	984,916	913,201	992,319
May 9	981,370	908,213	974,078
May 2	981,711	913,550	961,617
April 25	959,225	878,387	962,578
April 18	922,778	876,916	970,042
April 11	917,284	880,937	945,271
April 4	922,375	861,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
February 28	862,910	944,514	916,624
February 21	925,295	945,679	830,187
February 14	902,877	935,589	816,646
February 7	928,244	906,017	849,352
January 31	896,055	929,623	865,314
January 24	924,254	894,481	896,464
January 17	932,150	894,851	864,297
January 10	932,807	872,023	873,908
January 3	765,727	706,292	727,246

VULCAN BULLETIN

Vulcan Iron Works, Wilkes-Barre, Pennsylvania, the well known builders of locomotives, have just issued an 8-page bulletin, Number 102, featuring their 16 and 20 ton gear driven gasoline locomotives. Complete specifications and general description of these two sizes is included as well as hauling capacity charts.

Producing Asphalt Sand Efficiently And By Entirely New Method

Founders Sand and Supply Company Separates By Dry Method. New Efficient Plant Producing 1000 Cubic Yards Daily.

ASPHALT sand is used both in the binder and wearing coarse of asphalt pavements. An asphalt pavement consists of a mixture of coarse mineral aggregates such as broken stone, sand or combinations of stone and sand with a finely divided mineral filler, such as limestone dust or portland cement, and asphalt cement. It is interesting to note here that hydrated lime is being investigated as a desirable mineral filler. In the binder coarse of a sheet asphalt pavement, which is probably more extensively laid than any other type of pavement, 250 pounds of sand are used to a 1000 pound mixture, while in the wearing coarse 745 pounds of sand are used to a 1000 pound mixture. This means that about 100 pounds of sand are used to every square yard of asphalt pavement. As 130,000,000 square yards of asphalt pavement were laid during 1924, about 6,500,000 tons of sand were used for this purpose.

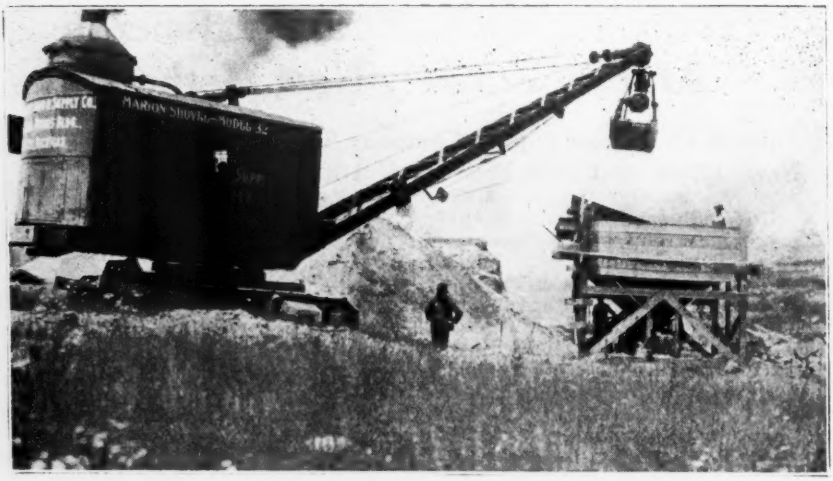
Specifications for sand for asphalt pavement purposes can all be summarized into the following sieve analysis.

Passing	Retained On	Percentage
8	40	25-35
40	80	35-45
80	200	25-35

Not over 5 per cent will be permitted to pass the 200 mesh screen. The contractor prefers to have 2 per cent pass the 200 mesh and the analysis to run 20-50-30.

Sand for asphalt use is generally produced by a wet method. The sand is washed and then separated. With such a process the sand seems to lose some of its clay qualities that are desirable in asphalt pavement construction. The Founders Sand and Supply Company is the first organization, to the knowledge of the editor, to separate the asphalt sand successfully by a dry method. This company has built a plant for the express purpose of producing a sand for use in asphalt pavement. This sand is separated by screens ahead of the wash-

View Showing Field Conveyor Coming in at Right Angles to Conveyors to Asphalt Plant

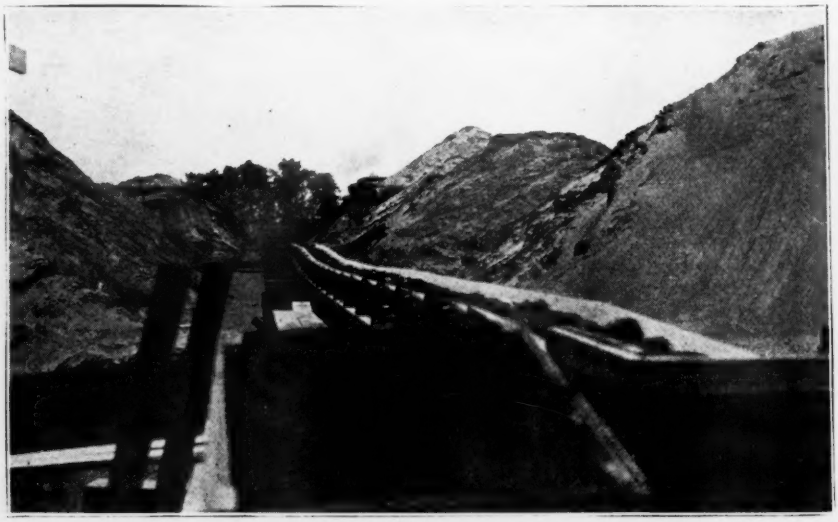


Shovel Discharging to Field Hopper

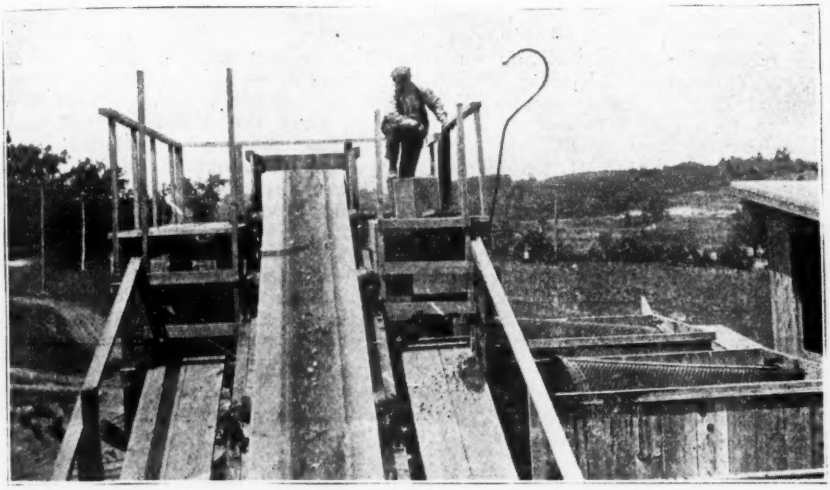
ing plant, and all material over one inch in size is passed to the washing and screening plant for preparation into commercial gravel sizes for other purposes. This material so passed is in reality a by-product.

This interesting plant is located at Rochester, Michigan, on the Michigan Central Railroad about 20 miles from Detroit. Spur tracks from the main line run into the plant and all shipments are made by rail. One of the interesting features of the plant is the fact that one system of plant transportation is used. The material is loaded onto a belt conveyor and carried through the entire plant to the loading bins by belt conveyors. The system is entirely automatic resulting in a minimum of labor and a low power cost.

A Marion model 32 steam shovel mounted on caterpillars loads the material into a traveling field hopper mounted on a traveling field conveyor. This field conveyor is 350 feet centers and travels on a series of rails mounted on timbers. This belt conveyor is designated as unit "T" in the drawing accompanying this article.



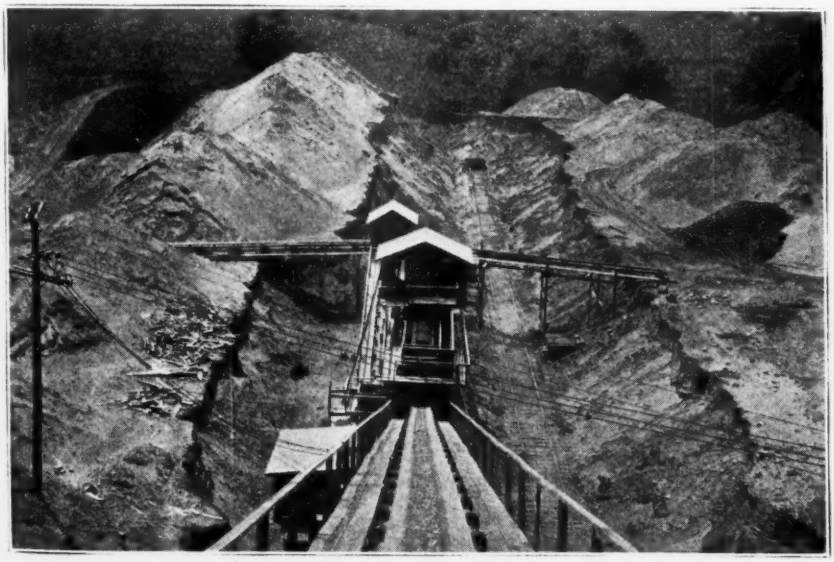
The Field Conveyor



Conveyor from Asphalt Plant to Washing Plant

This portable field conveyor discharges into a receiving hopper from which the material is fed by a belt feeder 6½ feet centers to another belt conveyor 160 feet centers and at an elevation of 18 degrees. This second belt conveyor or unit "C" discharges to a number 9 Stephens Adamson scalping screen 42 inches by 14 feet. The oversize from this screen is discharged to a number 4 Allis Chalmers gyratory crusher type N. After crushing the material is discharged to a belt conveyor, unit "F," and conveyed at an angle of 19 degrees to a hopper ahead of the scalping screen. The material is then drawn from this hopper to belt conveyor unit "C," and again discharged to the number 9 screens.

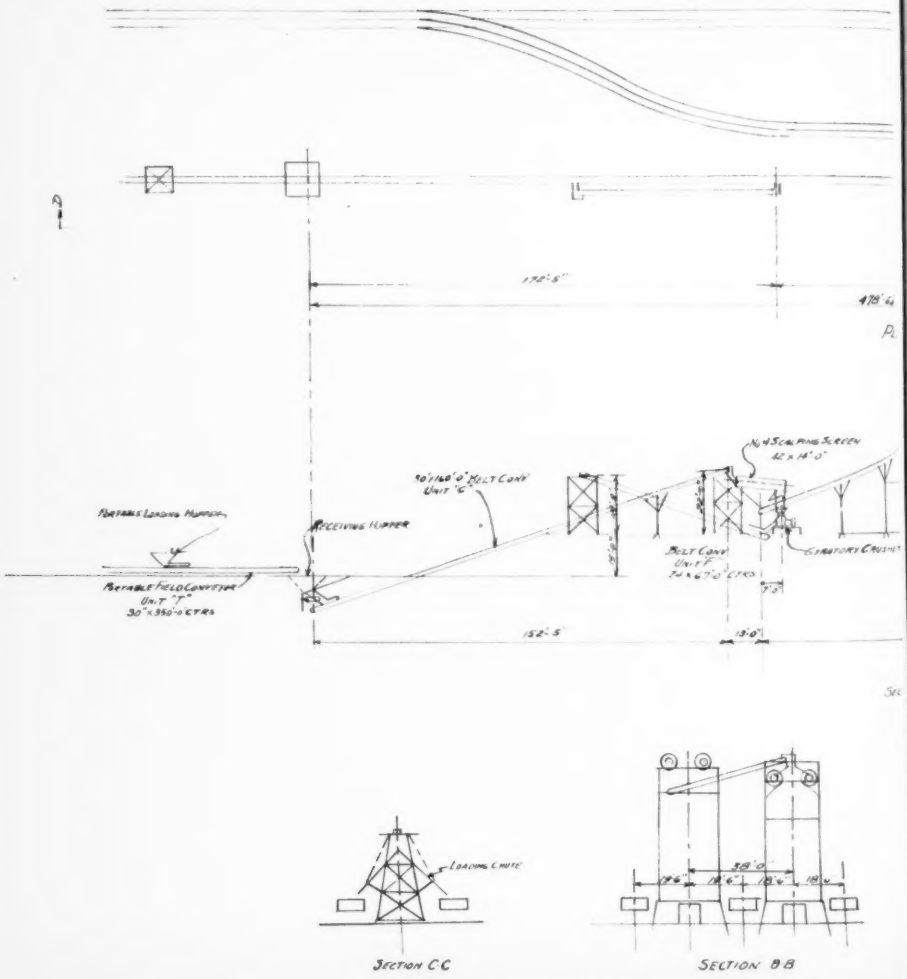
The material passing the number 9 screen is discharged to another belt



Looking Down from the Asphalt Plant

conveyor, unit "G," 195 feet centers, and elevated at an angle of 20 degrees to a specially designed asphalt sand screen. This screen is number 9 with a special 72 inch asphalt sand jacket. It is 48 inches by 24 feet. It is in fact a double screen with the first screen 48 inches by 24 feet which separates out all material over 1 inch. All material under 1 inch passes through the first screen to the 72 inches by 24 feet special screen for grading the asphalt sand. This arrangement reduces the wear on the finer screen. Another novel feature of this screen is the fact that the wide openings are nearest the receiving end.

The asphalt sand is discharged to dry sand bins below the screen. These bins have a storage capacity of 2000 tons. They are 35x48x22 feet. Material can be loaded direct to cars from these bins or it can be reclaimed by a tunnel conveyor, unit "R," which is 143½ feet centers. In the construction of this dry asphalt sand plant provision has been made for another special screen should the need arise. This screen was designed and built by the Stephens Adamson Manufacturing Company. There is no

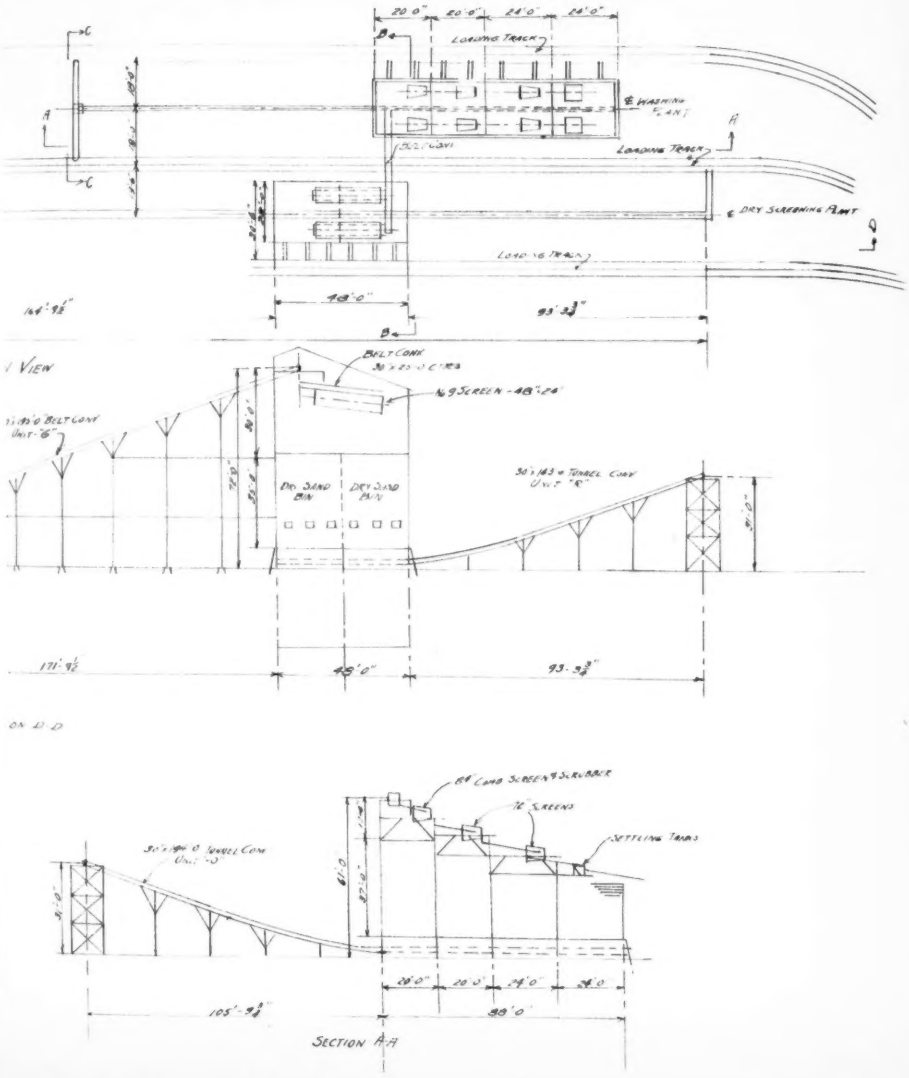


Views Showing Arrangement of the Rochester

other successful method of separating asphalt sand dry to our knowledge. From this point on the other material, which is in reality a by-product, passes to the washing plant.

All material not passing the 1 inch screen of the number 9 special and all material separated out by the inner screen, being over 1 inch, is discharged to an inclined belt conveyor 50 feet centers and conveyed to the washing and screening plant. Here the material passes through 84 inch Gilbert scrubbers and 72 inch Gilbert screens to number 3 Stephens Adamson sand settling tanks. An interesting feature of this washing plant is the combination of the Gilbert screen and scrubber into one unit.

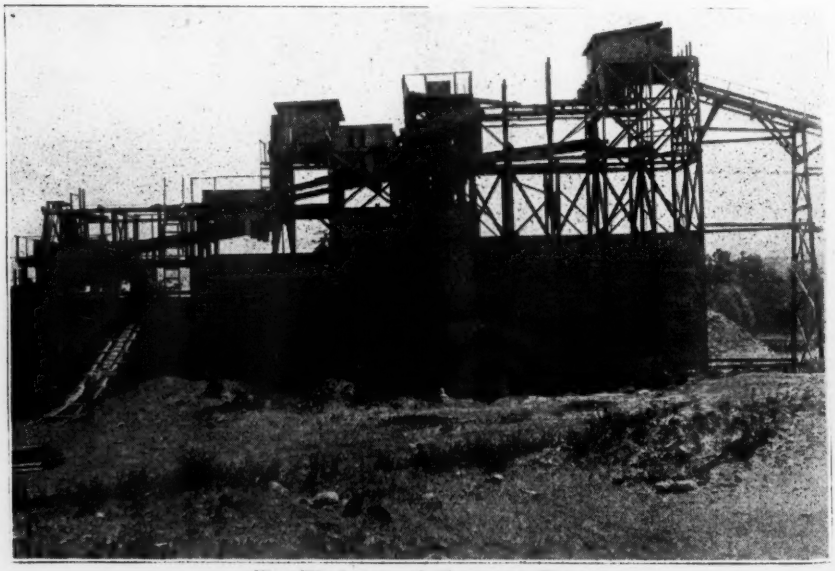
In the washing plant the material first passes to either of two combination 84 inch Gilbert screen and scrubber machines. The scrubber, which is rotating, is fitted with high pressure



Plant of the Founders Sand and Supply Company.

The Combination Scrubber and Screen

water jets and is lined with vanes. The water with the mechanical action breaks up and mulches the clay in the gravel. The material passes from the scrubber through either set of two 72 inch Gilbert Screens which are fitted with outer jackets. The fines and waste water are discharged into Stephens Adamson settling tanks. The waste water is carried away by a wooden flume. Water for washing is pumped through a cast iron pipe line to the plant at the rate of 1800 gallons per minute by an American Well Works pump. There is storage for 2,500 tons of sand from the washing plant. The plant is electrically operated with a total of 170 H. P. All motors are of General Electric manufacture.



The Washing and Screening Plant

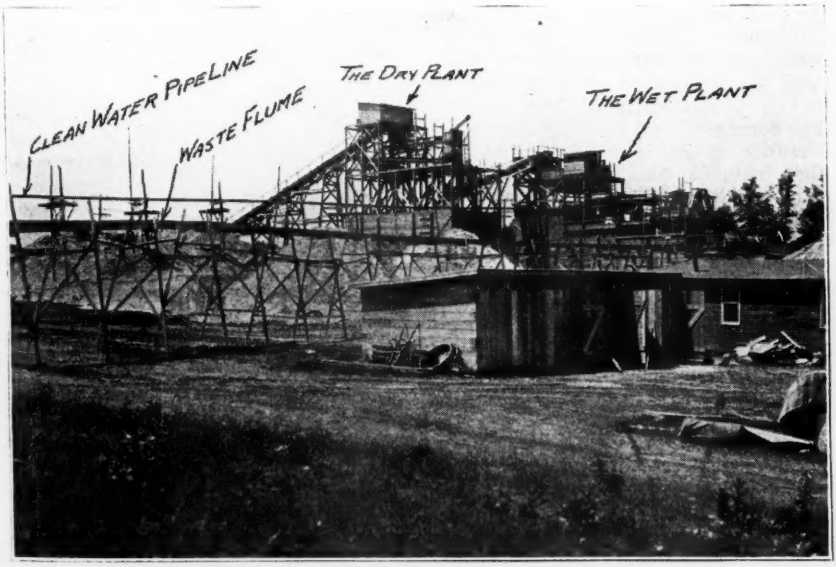
All the conveyors in the plant are 30 inches wide operating on ball bearing conveyors with Stephens Adamson special 6 ply rubber belting. The field conveyor is the only movable conveyor in the plant, and it is so arranged that the portable loading hopper can be moved to the loading position of the shovel and the material can be excavated in a circle from the receiving hopper ahead of the belt conveyor designated as unit "C."

The storage bins of both the dry and wet plants are built of wood and fitted with Stephens Adamson duplex bin gates. Material can be loaded directly to cars or can be reclaimed from storage by tunnel conveyors. With a wet storage of 2500 tons there is a combined storage capacity of 4500 tons. Cars can be loaded on both sides of both the wet and dry storage bins.

In the construction of the plant it was necessary to cut through the bank of gravel to build the spur tracks and the plant itself. The plant was designed and installed by the Stephens Adamson Manufacturing Company of Aurora, Illinois. The present capacity is 1000 cubic yards daily.

The Founders Sand and Supply Company also operates pits at New Lexington, Ohio; Marysville, Kentucky; Elberta, Michigan; and Ottawa, Illinois. In these various pits moulding sands, core sands, glass sands, silica sands, building sands and gravel are produced. With the new plant at Rochester, Michigan, producing asphalt sand as well as the other sand and gravels, this company will be a dominant figure in the sand and gravel industry. The moulding sand property at New Lexington, Ohio, is the largest of its kind in the State of Ohio. This plant is now producing 1000 tons daily. The new plant at Rochester covers a deposit of 100 acres so there will be plenty of material for some time to come. Mr. H. A. Mendelson is president and treasurer. Mr. S. L. Fitzpatrick is vice president and general manager.

George T. Sinks has been appointed New York district sales manager of the McMyler-Interstate Co., Cleveland, builder of locomotive cranes, car dumpers and other conveying equipment and fabricator of structural steel. He succeeds George E. Titcomb, who recently was appointed vice-president in charge of sales with headquarters in Cleveland. Mr. Sinks' offices are at 1074 Woolworth building New York.



General View of Buildings and Water Handling Facilities

The Building Situation

DESPITE the extraordinary rate of construction activity which has continued without interruption since 1922, and the growing evidence that in many sections the shortage of building space has been largely, if not entirely, removed, current reports indicate that this year's activity will approximate, and perhaps surpass, even the record figures of recent years, states the current issue of the "Guaranty Survey," published by the Guaranty Trust Company of New York.

Building contracts awarded last month in 36 States, as reported by the F. W. Dodge Corporation, represented a total value of $496,024,100. The figures for these States are believed to include about seven-eights of the entire construction of the country. The May total is the highest ever recorded in the history of the industry, with the exception of that for the preceding month, which was $546,970,700. As compared with the value of contracts awarded a year earlier, the May figure shows an increase of 18 per cent.

Contracts awarded during the first five months of the year had a value of $2,119,564,100, which is nearly 10 per cent larger than the 1924 figure and 22 per cent above that for 1923. The area of floor space represented by this year's contracts, however, is slightly smaller than that of a year ago.

The large volume of work begun this year is especially striking in that it has been achieved in spite of a drastic decline in the New York district, which includes New York State and northern New Jersey. In January and again in May, this year's valuaions in this district exceeded slightly those of last year. But in the intervening months the 1925 figures were much lower, and in March the total was less than one-half that of a year earlier. For the first five months of this year the aggregate is 24 per cent lower than that of the corresponding period in 1924.

In drawing these comparisons, however, it must be remembered that last year's activity was strongly influenced by the tax-exemption privileges in New York which expired in the spring of 1924, the "Guranty Survey" continues. With this impetus removed, it was to be expected that this year's building would show somewhat smaller totals. Nevertheless, the abrupt decline in February, after the sustained high level which continued throughout last year, suggests that the reduced activity of recent months may have a deeper significance.

The gains over last year's activity are fairly evenly distributed throughout the country. With the New York district eliminated, the total for the 36 States is 27 per cent larger than that of a year ago. Except for the Northwest, where a very slight decline is reported, every district shares in the gain. The increases range from 7 per cent in the southeastern States to 55 per cent in the Pittsburgh district, which includes western Pennsylvania, West Virginia, Ohio and Kentucky.

As regards costs, the industry is apparently in a more stable condition than at any other time in recent years. Both in the building industry itself and in the manufacture of building materials, operators have gradually become better adjusted to the unprecedented rate of activity of the last three years. Most of the labor contracts signed this year embody renewals of existing wage rates. Although the average level of building wages has continued to rise slowly, the advances in recent months have been due to the making of new agreements in which old rates have been raised to the levels now generally prevailing. The critical period of contract renewal this spring was passed with gratifying absence of serious disturbances.

More recently, however, the country's building program has been threatened by the outbreak of an old controversy between two labor unions over the question of jurisdiction. Representatives of the organizations involved have been in conference with the Secretary of Labor this month in the effort to avoid an interpretation of building operations estimated to amount to $100,000,000.

It seems probable that, under favorable conditions, building activity will remain high throughout this year, and that next year's operations will be well above the average. But the industry is well known to be highly senstitive to adverse influences.

Factors Governing Modern Lime Kiln Capacity and Fuel Economy

By Victor J. Azbe, Consulting Combustion Engineer*

Part IV.

Part I of this paper appeared in the June first number of Pit and Quarry. Actual fuel lime ratios, heat distribution in theoretical kilns and kiln efficiency rating were discussed.

In Part II, which appeared in the June 15th number, effects of excess air on lime kiln efficiency, incomplete combustion, and heat loss by radiation were discussed.

In Part III, published in the July 1st number, kiln performance was discussed from gas analysis, and the results of kiln gas analysis tests made at different plants were presented and discussed.

This paper was prepared by Mr. Azbe for the Seventh Annual Convention of the National Lime Association held at Briarcliff Manor, New York, May 26, 27, 28 and 29, 1925. It will be published complete in six parts in consecutive numbers of Pit and Quarry.

Editor.

Reduction of Kiln Efficiency During Drawing Period

Figure 12 illustrates firing conditions in three different plants during drawing periods. Plants A and B are hand fired; plant C is gas fired. In the case of Plant A it took 102 minutes to draw tne kiln and clean the grates. In Plant B it was even worse, and the time required was 150 minutes at the time observation was made. During part of this time whatever coal was burned was burned very inefficiently. During part of the time all heat generated was wasted, and during the greater part not only no heat was obtained from the gases of combustion, but actually, since they were cooler than the lime on account of the great excess of air, the condition of reverse heat flow took place and the lime in the kiln heated the gas passing up through the lime.

Compared with A and B, Plant C results are very good. For the entire period of drawing and punching, only 24 minutes were required and only during a very short portion of this time oxygen went high.

It is very important that the kiln be so designed and so operated that there are not too great interruptions due to drawing and cleaning; otherwise, kiln efficiency and capacity are greatly reduced.

Lime Kiln Heat Transfer

A lime kiln is as much a heat transfer apparatus as is a boiler or a radiator. Heat transfer occurs from the hot flame and hot gas to the lime and limestone by convection and radiation; then it passes by conduction to the inner layers.

Heat transfer by radiation depends upon temperature difference and relative luminosity of the two heat interchanging objects. It will vary as the fourth power of the absolute temperature difference, and the radiated heat will penetrate to the surface of lime through the insulating layer of cooler gas at the speed of the light.

The rate of heat transfer by convection depends upon temperature difference and gas velocity. The higher either is, the higher will be the heat transfer. Convection heat transfer is impeded by the undulating value of the cooled gas next to the lime; so the higher the velocity or turbulency, the faster will the cooled film be swept off and substituted by a better film. Convection heat transfer is independent of radiation heat transfer and vice versa, except that if a surface becomes heated by radiation, it will receive less heat by convection.

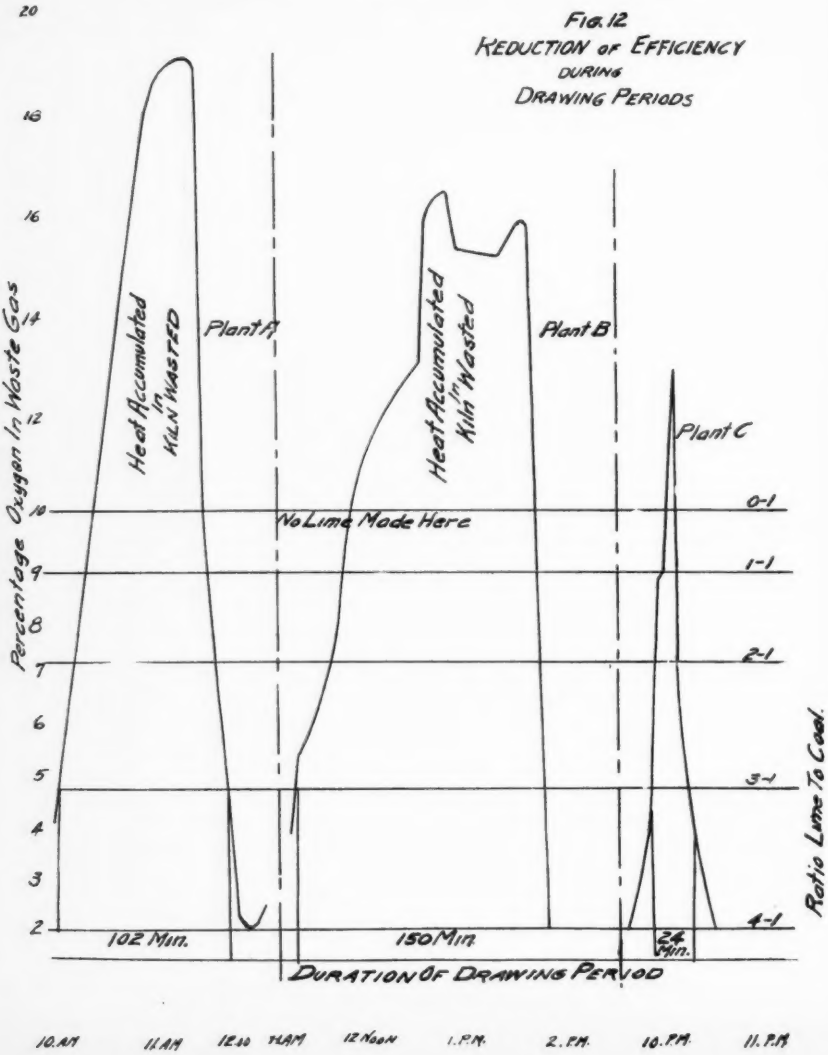
Heat transfer through lime and limestone depends upon its heat conductivity which is a fixed figure for a certain stone or lime. Through limestone the conductivity will be greater, due to its solidity but may vary some with different stones due to their difference in physical makeup. Through lime the conductivity will be less than through stone due to its porosity and consequent concussion of gas particles which act as a heat insulating medium. It will also vary more and will depend in the main upon the size of the pores.

A luminous flame will transfer much more heat than a non-luminous

flame because heat transfer by radiation is not impeded. A non-luminous flame will transfer from 2 B. T. U. per square foot per hour per degree difference in temperature and up with the usual figure that may apply to lime kilns at 5 B. T. U. A highly luminous flame may have a heat transfer rate of 20 B. T. U. or four times as great. This relative heat transfer is very important in lime kilns, and a luminous flame is greatly to be preferred.

Flame luminosity is caused by small highly heated particles of carbon in the gas, and when these are present, combustion is retarded. If too much air is used or if the mixture of air and combustible gas is very intimate, the flame may be very short and non-luminous. Almost all heat then will have to be transferred by convection.

The writer tested kilns having efficient fuel burning equipment and found that combustion was very good. Still, results were poorer than was the case in the kiln where coal burning equipment was poor but such that combustion was retarded and high flame luminosity obtained.



A kiln properly designed for retarded combustion will make better lime and more lime, because heat transfer will be greater in spite of lower temperature difference. Then, the kiln life will be longer, because heat will be used as it is generated, thus cutting down local high temperatures such as are often found in front of kiln eyes.

A luminous flame to be effective in lime kiln must, however, be long enough to penetrate up to where the partially burned limestone is. To have a luminous flame in the kiln immediately on the level of the eyes helps little since the lime there is completely burned with little, if any, core in it and is practically at the same temperature as the flame and highly luminous, so a heat transfer by radiation cannot take place. Under these conditions often before the gas has reached the point where luminosity would help, the carbon particles are burned out, and the flame luminosity becomes insufficient.

It is due to the desirability of having retarded combustion that the absence of hydrogen gas to as great an extent as possible becomes important. This gas burns at great speed, about twice as fast as carbon monoxide, and it is said 15 times as fast as methane.

For high rates of heat transfer by convection it is necessary that gas velocity be high. If gas velocity is high, the draft drop will be greater. The gas will also stay in the kiln a proportionately shorter time so if high heat transfer by convection is wanted, the kiln must be designed with that in view. Otherwise the heat transfer will be great, but terminal temperatures on the kiln top will be too high or the draft drop too great. This will be again discussed in the section dealing with "Factors Affecting Kiln Capacity."

It may be further mentioned that there are cases when there is a reverted circulation of gas in a lime kiln. Reversed circulation in the precooling zone is quite frequent, and it is due to the fact that the tendency of cold air to pass down is greater than the velocity energy of hot gas to go up. It could also be said that the gas going up selects preferential channels leaving others idle through which the air passes down. At a point which may be as low as 20 feet in the kiln, the two mix and pass up together at a much lower temperature which reduc-

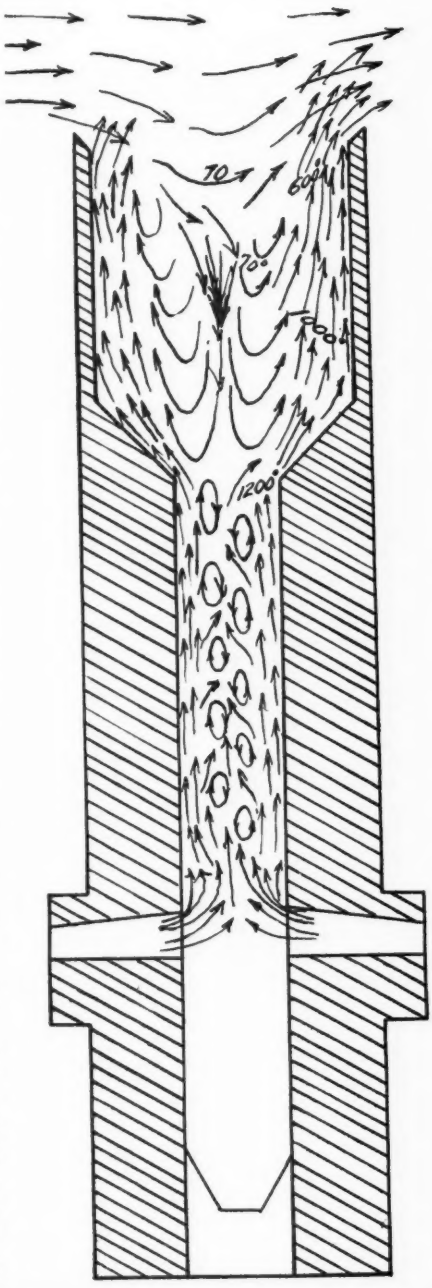


Figure 13. Hypothetical Gas and Air Currents in Operating at Low Capacity.

es the temperature range to which stone is preheated in a certain distance of travel through the kiln. In Figure 13 I have attempted to demonstrate this contention. While I have proof that this occurs in the preheating zone, I have no such proof that it does occur in the burning zone. But if velocity is low, that is, the kiln is operated at a rate below its shaft area proportion, then I do not see why it should not occur, especially since the draft differences are so small and neutral.

Kiln Capacity, Rating, Proper Kiln Proportion and Operation

A boiler output is rated on the basis of evaporation per square foot of heating surface and boiler size in terms of number of square feet of heating surface. No such definite figure is used in connection with lime kilns, and so one does not know if 15 tons of lime from a kiln per day is good or poor output. Evidently it must be good when the kiln is very small and poor if it is very large. Some definite basis for rating kiln size should be of considerable value, and the writer for a time used the "pounds of lime per square foot of shaft area," expression. It is not very satisfactory, however, since kilns vary greatly in height.

It is evident that the heating surface in lime kilns, (the lime and stone surface where the heat is absorbed), is the proper basis of rating lime kilns as well as boilers; but what is the heating surface of the lime kiln? In any case the heating surface is closely proportional to the cubical content of the lime kiln. Therefore, why should the lime kiln capacity not be based on the content figure and the output judged by the expression of "cubic feet of lime kiln space per ton of lime output," or "tons of lime per day per 1,000 cubic feet of kiln space?"

A kiln that will have an output of a ton of lime for 121 cubic feet of kiln content is operating at a higher capacity than the kiln producing the same amount of lime for 161 cubic feet of effective kiln content, in spite of the fact that the first is producing only 10½ and the second 18½ tons of lime per day. This actually occurs in kilns that are designated in the accompanying Table 11 as P-18 and MG. P-18, being a larger kiln, and having more surface to absorb heat, should rightly make more lime; but, due to less efficient use of this surface the amount of lime made for equal cubical content is much less. In other words, the kiln putting out the

(Continued on page 68)

Table II
Dimensions and Performance Factors of Various Kilns

KILN	P-18	G	M	MG
TONS OF LIME PER DAY	18.5	22.5	10	10.5
Kiln cross-section at eyes	5'x9½'	5'x7'4"	5'x7½'	4'4"x6'10"
Area of shaft at eyes, square feet	47.6	36.7	37.5	29.5
Eye gas entrance area to kiln, Sq. Ft.	25.9	20.8		12.9
Percent entrance area of shaft area	54.4%	57%		44%
Total height above bottom of draw hopper	51'9"	50'8"	43'	39'
Height above cooler working kiln height	42'6"	40'	34'6"	30'6"
Shaft height between cooler and storage	26'3"	21'	21'3"	20'7"
Cooler depth	9'	10'8"	9'	8'6"
Cooler space, cubic feet	291	340	240	165
Shaft space, cubic feet	1251	900	790	665
Storage space, cubic feet	1723	1500	1460	605
Total kiln space	3265	2740	2490	1435
EFFECTIVE SPACE, CUBIC FEET SHAFT AND STORAGE	2974	2400	2250	1270
Lime equivalent of lime and limestone above eyes, tons	83	67	63	35
TIME OF TRAVEL THRU STORAGE AND BURNING ZONE	3.8 da.	2.5 da.	5.4 da.	2.8 da.
Average kiln cross-section, square feet burning and storage zones	70	60	65	41.7
Pounds of lime per square foot, average kiln cross-section (burning and storage zone cross-section)	530	750	308	504
RELATIVE TIME GAS REQUIRES TO TRAVEL THRU KILN	124%	100%	93%	53%
Shaft gas velocity relative	.63	1.0	.44	.55
Shaft and storage space velocity relative	.71	1.0	.41	.67
CUBIC FEET EFFECTIVE KILN CONTENT PER TON OF LIME	161	107	225	121
Storage cubic feet per ton of lime	93	62.5	146	57.6
Shaft cubic feet per ton of lime	67.7	40	79	63.4
Cooler cubic feet per ton of lime	15.8	15.1	24	15.7

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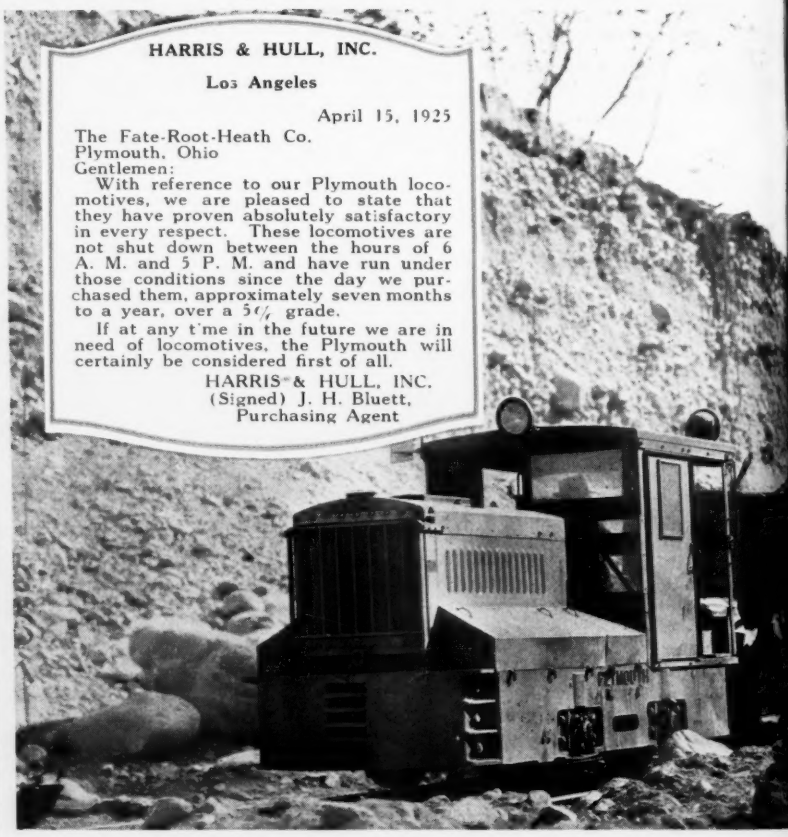

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Los Angeles

April 15, 1925

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(Signed) J. H. Bluett,
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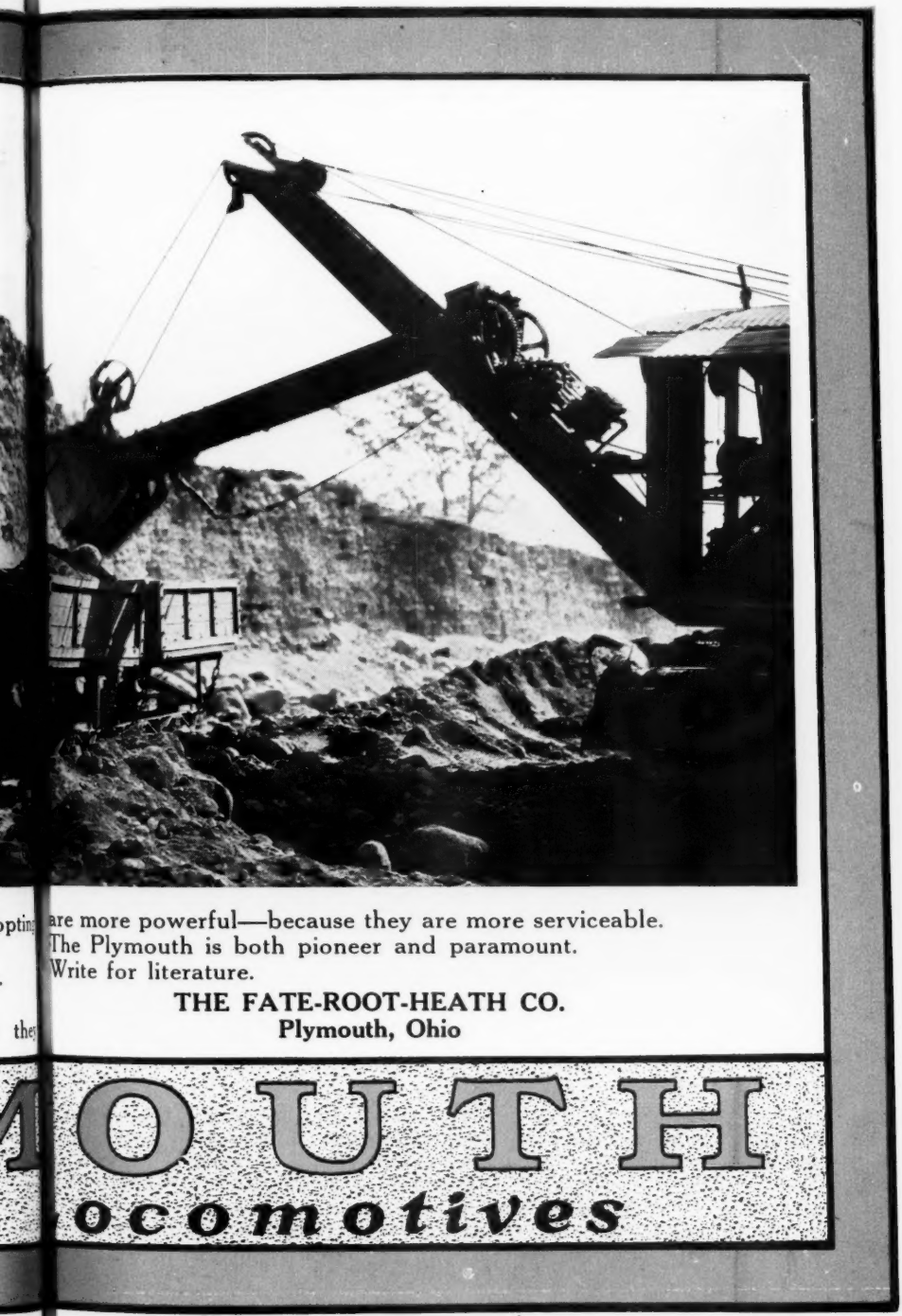

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The General Rate Structure

Written Expressly For PIT AND QUARRY By J. H. DONNELL*

THE INTERSTATE Commerce Commission in compliance with Senate Joint Resolution 107, better known as the Hoch-Smith resolution, has ordered a general investigation of the rate structure. This resolution has been the subject of much controversy and has created a greater stir than any other transportation legislation in recent years. The resolution follows:

"Resolved by the Senate and House of Representatives of the United States of America in Congress assembled; That it is hereby declared to be the true policy in rate making to be pursued by the Interstate Commerce Commission in adjusting freight rates, that the conditions which at any given time prevail in our several industries should be considered in so far as it is legally possible to do so, to the end that commodities may freely move.

"That the Interstate Commerce Commission is authorized and directed to make a thorough investigation of the rate structure of common carriers subject to the interstate commerce act, in order to determine to what extent and in what manner existing rates and charges may be unjust, unreasonable, unjustly discriminatory, or unduly preferential, thereby imposing undue burdens, or giving undue advantage as between the various localities and parts of the country, the various classes of traffic, and the varous classes and kinds of commodities, and to make, in accordance with law, such changes, adjustments, and redistribution of rates and charges as may be found necessary to correct any defects so found to exist. In making any such change, adjustment, or redistribution the commission shall give due regard, among other factors, to the general and comparative levels in market value of the various classes and kinds of commodities as indicated over a reasonable period of years to a natural and proper development of the country as a whole, and to the maintenance of an adequate system of transportation. In the progress of such investigation the commission shall, from time to time, and as expeditiously as possible, make such decisions and orders as it may find to be necessary or appropriate upon the record then made in order to place the rates upon designated classes of traffic upon a just and reasonable basis with relation to other rates. Such investigation shall be conducted with due regard to other investigations or proceedings affecting rate adjustments which may be pending before the commission.

"In view of the existing depression in agriculture, the commission is hereby directed to effect with the least practicable delay such lawful changes in the rate structure of the country as will promote the freedom of movement by common carriers of the products of agriculture affected by that depression, including livestock, at the lowest possible lawful rates compatible with the maintenance of adequate transportation service: **Provided,** That no investigation or proceeding resulting from the adoption of this resolution shall be permitted to delay the decision of cases now pending before the commission involving rates on products of agriculture, and that such cases shall be decided in accordance with this resolution.

"Approved, January 30, 1925."

There are two principal phases of the situation to be considered by every shipper, namely:

1. Is it constructive legislation and as such should it be permitted to stand or is it harmful and therefore better repealed
2. Now that the resolution has been enacted into law, what is the most practical thing for the shipper to do in order to protect his interests?

The Associated Traffic Clubs of America adopted a resolution condemning the law and urging its repeal. In part, the resolution said:

"The Associated Traffic Clubs of America have consistently condemned the theory of making rates for the purpose of aiding any industry that for the moment might not be in prosperous condition. We reaffirm these policies, and advocate a return thereto by repeal of the legislation known as the Hoch-Smith resolution.

"We deprecate the recent trend of Congress in substituting its judgment, untrained technically, for that of the Commission and its technical staff, in

*Traffic Counselor. La Salle Extension University.

the highly technical problems involved in the making of freight rates, and we confidently believe that this trend, if pursued, will proceed to a breakdown of confidence in the Commission's decisions and in the equity and stability of our rate fabric, and, finally, will jeopardize some of the prime essentials of private ownership."

The National Industrial Traffic League approved a statement to be filed with the Interstate Commerce Commission in which it said, among other things:

"Our conclusion is that the Hoch-Smith Resolution does not change existing law. Its only effect is to direct the Commission to institute a comprehensive, general investigation into the entire rate structure of the country. During the progress of such investigation, as expeditiously as possible, the Commission shall, from time to time, make such decisions as it may find to be necessary and which the record may justify. The resolution as drafted by Congressman Hoch, and as explained by him, calls for action by the Commission, making 'such adjustments from time to time as the record then made justified.' (See hearings before Committee on Interstate and Foreign Commerce, 68th Congress, April 3rd to 9th, 1924, page 22.)

"These adjustments which the Commission is authorized to make from time to time during the progress of the investigation, are exactly what the Commission is authorized and directed under existing law to make upon formal complaint or upon any investigation instituted by the Commission upon its own motion.

"The Hoch-Smith resolution, in line with the expressed policy of Congress in Section 500 of the Transportation Act, requires the Commission in making any change, adjustment or redistribution of transportation costs, to give due regard, among other things, to the maintenance of an adequate system of transportation, or, as stated in paragraph 3, of the resolution, 'the maintenance of adequate transportation service.' The 38th annual report of this Commission to Congress shows that the carriers, as a whole, are not receiving a return of 5.75 per cent on the fair value of their property used for transportation purposes. During the past two years the carriers of the United States have rendered an especially satisfactory service to the public. The Commission should take no action as a result of this investigation which will impair the ability of the carriers to render efficient transportation service. If reductions in rates important in amount be made upon particular commodities, it is obvious that increases in rates must be made upon other commodities. In the announcement to the public of March 12, 1925, the Commission requested that there be pointed out any traffic or commodities receiving undue advantage or on which compensatory increases could be placed to offset reductions sought and that may be found necessary. The nature of this organization and its purposes precludes any expression in this statement as to what, if any, commodities or localities are not paying their fair share of transportation costs. The duty of making such suggestions to the Commission must be performed by individual shippers and especially by the carriers of the country.

"We urge that the Commission adopt a construction of the resolution which will not impair the fundamental principles of the Interstate Commerce Act; that it prescribe rates which, in and of themselves, are just and reasonable, which give no undue preference or advantage to any class, industry, or commodity, and throw no undue burden upon any commodity, person or community, and which will maintain individual carriers and an efficient transportation system as a whole. The Commission cannot lawfully abandon any of these fundamental standards in rate construction laid down by statutory development during thirty-seven years, or be swayed by any 'deference naturally paid to the supposed wishes of Congress.' The public looks to this Commission to maintain a leadership, and an independence of thought and action, governed solely by the law of the land. A great mass of facts bearing upon the lawfulness of rates, the needs of commerce and of the carriers, will be developed in this investigation. We expect the Commission to apply the standards of lawfulness to the facts revealed and to announce its conclusions as expeditiously as possible. The public is entitled to nothing less."

In addition to the foregoing statements, many other organizations and individual firms have expressed opinions either in favor of or opposed to the repeal of the law. Alfred P. Thom, General Council of the Asso-

ciation of Railway Executives, in replying to an inquiry addressed to him by Mr. Henry A. Palmer, Editor of the Traffic World, said:

"I have received your letter of the third instant in which you say:

" 'It has been said in debate that the railroads are not opposed to the Hoch-Smith Resolution and did not oppose it when it was pending in Congress, and you have been quoted as having told a committee of Congress that the railroads were not opposed to it.'

"You ask me to make a statement on this subject.

"It is an entire mistake to suppose that I ever told a committee of Congress, or anybody else, that the railroads were not opposed to the Hoch-Smith Resolution.

"The facts are that, when Mr. Hoch introduced his original resolution, I thought it was in very objectionable form and contained some very hurtful statements. I was much opposed to it in this form. Afterwards, it was greatly modified and took a form which it was thought simply required the Interstate Commerce Commission to do what it was already doing every day. I did not see any sufficient reason for passing a resolution to require the Interstate Commerce Commission to do what it was already doing, but I desired to avoid the charge of occupying the unreasonable position of offering objection to everything that was proposed. I, however, made no statement, that I can recall, to any committee on the subject. I, doubtless, said that, in its modified form, I did not intend to appear in opposition to it.

"But, after this, it was substantially amended by adding to it some of the provisions of the Smith Senate Resolution, and became what is now known as the Hoch-Smith Resolution. To this I was much opposed, and so expressed myself. As there were no committee hearings, I was unable to make an argument on the subject or to put my objections into an effective form.

"Personally, I greatly deplore the passage of the resolution. I think that its effect may be largely to disturb business, and I cannot see that its passage was justified. While I have not been authorized to make any statement on their behalf, I feel safe in expressing the belief that the railroads did not favor the passage of the resolution in its present form, saw no reason or justification for the passage of it in any form, and feel apprehensive that the effects of a nationwide investigation of the rate structure may be more hurtful than helpful to the best interests of the country."

I think it may be safely assumed that relatively few persons are kindly disposed to the law or that they believe it will constructively operate to better the rate structure. Even those who, either negatively or actively, oppose its repeal, seem to be influenced by a policy of expediency rather than by a desire to see the law become operative. In any event there seems to be a wide difference of opinion as to whether or not existing law is actually changed by this resolution.

As a matter of fact, if the Hoch-Smith Resolution does add anything to existing law, then it is assuredly a harmful piece of legislation, and if it does not add to existing law then at best it is utterly useless, and harmful to the extent that it takes the time, thought, effort and attention of the Commission away from important rate investigations now pending, thus effectively delaying rather than speeding up an intelligent readjustment of the several territorial rate structures.

Moreover, it may be assumed that a general investigation such as contemplated by the Hoch-Smith Resolution will prove to be a very expensive luxury, because it costs the government an immense sum to conduct such an investigation and this money comes out of the treasury, that is, the public pays for it. There is a very legitimate doubt as to whether the public should be taxed with the cost of something which is so generally presumed to be detrimental rather than beneficial to its interests.

Certainly no general recognition has yet been given to this legislation as constructive or desirable. On the other hand, the denunciation of it has been very widespread. It does not reflect a knowledge of transportation conditions or of those essential factors employed in rate making. If the framers of the bill intended it to promote the free movement of agricultural products, then it may be said that the resolution itself will in large measure tend to defeat that object, because in the first place, freight rates are not responsible for the depression in agriculture. In the second place, the instructions to the Interstate Commerce Commission as contained in the Hoch-Smith law are so indefinite and cover such a wide field as render it im-

possible for the Commission to accomplish the task within any reasonable length of time.

In a recent editorial discussion of this subject in the columns of the LaSalle Trade and Transportation Bulletin, I stated in connection with the impossibility of accomplishing a general rate investigation within a reasonable period of time that "this fact alone would nullify the intent of the law, because conditions in all lines of industry, including agriculture, are constantly changing, and it is not improbable that the Commission, if it ever completed a general revision of rates would find that, due to changed conditions, its work would have to be done all over again in order to take cognizance of such changes, and so on, ad infinitum."

That editorial also said:

"If that paragraph which instructs the Commission to give a 'due regard' to market values can be construed as compelling the Commission to attach a greater importance to market values than heretofore, or to consider the market value of the commodity as a determining factor rather than merely as one factor entitled to consideration, then this law introduces into rate making certain elements which the Commission, tho it may give consideration to them, has consistently maintained, have no determining value *per se* as rate-making criteria, which, moreover, tend to establish unstable and insecure bases for findings of reasonableness or unreasonableness.

"Market values influence and are influenced by commercial competition. Commercial competition influences and is influenced by production costs. Thus the Commission, if it is to effect a literal compliance with such an interpertation of the new law and give greater consideration to market values in the fixing of rates, must give consideration to production costs, among other things. Here we find the Commission compelled to go off into the highways and byways of exhaustive research, in an endeavor to find something they have never wanted, and something which they have frequently declared could serve no useful purpose in determining rate measures, something they have repeatedly found to be economically wrong.

"This law instructs the Commission to include in its investigations, all carriers subject to the Act, all localities, all classes of traffic, and all commodities. Inclusion of 'all commodities' may presumably remove this law from the realm of class legislation, although some doubt attaches here. No recognition is given to the present activities of the Commission, to the fact that it is daily going about its business in an orderly, constructive way, remedying conditions that need remedies, leaving alone those conditions which are found to be all right and therefore best let alone.

"It is too apparent to permit of much argument that a widespread disturbance of the rate structure, followed by similar periodical disturbances, will not benefit the farmer, the business man or anyone else. On the contrary, this legislation if not rescinded, may, and doubtless will, do serious harm. A disturbance of business, tending to decrease purchasing power — unsettled, vacillating, competitive conditions—will not help the farmer."

It is manifest that if reductions are to be made in rates on agricultural products that it will be necessary to increase rates on other commodities, because the Commission is still operating under the mandate contained in the Transportation Act of 1920 to allow the carriers a fair return upon the value of their properties and at no time since 1920 have the railroads as a whole, averaged the prescribed percentage of return.

It is highly improbable that one commodity may be subjected to higher rates in order that some other commodity may move freely on lower rates without eliciting some very stubborn resistance on the part of the shippers who are compelled to pay the higher rates, unless it can in fact be shown that such commodities are not at the present time bearing their full share of the burden in producing such revenues as may be necessary to the maintenance of an efficient transportation system. In any event, such readjustments as may be warranted could undoubtedly be more readily and expeditiously secured by the filing of complaints where the rates are really in need of readjustment than by the wholesale investigation of the rate structures which must of necessity consume much time in the investigation of reasonable rates as well as rates that are unreasonable.

It has been argued, and not without merit, that the Hoch-Smith law should be repealed, on the grounds that it is a bad law, at best a useless one. On the other hand, it has been contended that repeal of the Hoch-Smith law would result in the enactment of other and probably worse legislation to take the place of it. This latter contingency is so remote as to be highly improbable. It is reasonable to assume that if Congress were convinced of the desirability of rescinding the Hoch-Smith law, it would be doubly careful not to commit another "faux pas" by enacting other and even less popular legislation. Whether Congress could be brought to the point of repealing the law is problematical, but in view of the strong and concerted opposition so generally encountered, it is not unreasonable to assume that Congress could be made to see the light, if not at this session then at the next.

Now, regardless of whether or not one thinks the law should or can be repealed, the fact remains that for the time being at least, the law is in effect and operative. The Commission has issued its order number 17000 and briefs are being filed daily. Any and all who feel that they have a grievance may, under the broad terms of this law, file a brief with the Commission and seek a remedy for any rates which they have to pay and which they may feel are open to question. When "everybody's doing it" the individual must perforce look after his own interests. Competition compels such a course. This does not mean that one should file a brief or a complaint with the Commission just for the purpose of having one's rates investigated, whether any cause exists or not, but it does mean that the door is open to those who feel that they have legitimate cases. As a matter of fact, the door is always open and the Commission has never been found unwilling to give ear to reasonable demands for the consideration of meritorious cases involving rate adjustments.

In view of the fact that the law is operative, a very present reality, the recommendations of the National Industrial Traffic League are very appropriate in suggesting that the Commission adopt a safe and constructive interpretation of the law.

It will probably not be repealed, but if it is and until it is, a very conservative course on the part of the shippers and the railroads, as well as on the part of the Commission, is highly desirable. In most cases there is no reason to believe that rate adjustments may be secured under this general rate investigation which could not have been secured prior to the enactment of the Hoch-Smith law, and rate adjustments which were denied under the old order of things will probably meet with no more favorable treatment under Docket 17000 than formerly. Therefore, while it may be expedient to file briefs or complaints as a matter of self protection, especially in cases involving the competitive element, yet undue optimism as to probable future adjustments should be held rigidly in check if disappointments are to be avoided.

Flory Hoist Bulletin

A new catalog, Catalogue No. 39, devoted exclusively to Flory Gasoline Hoists has just been issued by the S. Flory Manufacturing Co., of Bangor, Pa.

The lists shown cover a complete line of standard sizes of Hoists from 5 to 60 H.P., built in single, double or three drum units, and with or without swinging gears.

The 20 H.P. outfits equipped with Fordson tractor motors are the company's specialty. These are built in a number of variations of capacities and speeds to meet various operating requirements.

The 10 H.P. outfits use LeRoi, Alamo or the new Continental motors. The 15 H.P. use LeRoi or Turmo units. The 35 H.P. uses Hercules, Continental or Buda motors, and the larger sizes use Climax motors. The same Flory standard of design and workmanship is maintained on these machines as is found in their line of steam and electric hoists.

A new 72 page general catalog will also shortly be issued, devoted to various types of hoists for construction and material handling operations.

The Scott Valve Manufacturing Company, of Detroit, Michigan, announces the appointment of H. P. Rodgers and Company, Leader-News Building, Cleveland, Ohio, as the Cleveland representative for the Scott complete line of bronze and iron body valves.

(*Continued from page 58*)

most lime is performing poorly, and its output on basis of performance of the smaller kiln should be 24.6 tons of lime or 33 per cent more.

In the same tabulation Kiln G performs even better than MG, the output being one ton of lime for 107 cubic feet of effective kiln content. On this basis kiln P-18 should have an output of 27.8 tons and kiln MG 11.7 tons. (Effective kiln content is the cubical content of the kiln minus the cooler.)

Kiln M performs the worst. The output is only ten tons, while on G basis it should be 21 tons. This performance is quite common since M kiln is a typical one, and the output from this type of kiln in all plants is about the same, about 10 tons.

Evidently there are other factors that control kiln output, but the same is true with boiler output. Boiler rating on a surface basis is however, quite practical and useful. It may be that not enough heat is furnished or not enough air to burn the gas properly, or there may be too much air and not enough gas. There may be many things that would throw the kiln performance downward, and fortunately most of them are controllable. If the same conditions are obtained on two different kilns, very nearly the same output will be obtained.

In the tabulation an effort was made to reduce the factors so that comparison is possible. The kiln shaft cross-section is important. If the kiln shaft is kept well filled with gas, a distance across the eyes of 6 feet is permissible; if not, 5 feet may be too much. The gas in the shaft must move at a good velocity; otherwise there will be channeling and re-circulation, and both kiln efficiency and capacity will drop off rapidly. The difficulty with M kiln was that not enough gas entered the kiln to fill the shaft properly, so channeling took place. While there was a great deal of heating surface in the kiln, the same was not working, since the gas was not equally distributed. In kiln G with high gas velocity in the shaft and storage zones, there is little short circuiting; all the space is working and so is all the surface.

One would think that a kiln having a high kiln content per ton of lime would be more efficient from the fuel standpoint because there would be more surface to absorb the heat. But the surface must be working, and in M it is not working while in G it is. Therefore G is very efficient in spite of low surface, while M is very inefficient, both from fuel and capacity standpoints, due to the low gas velocity and consequent poor distribution.

A kiln must also be so proportioned that the lime will travel through it at a proper rate and that the gas will not leave it in too short a time before it has a chance to give up its heat. MG has a relative gas travel of only 53 per cent that of G kiln. Naturally in this short time the gases will not be cooled as well as if a longer time had been allowed.

There is a correct height and correct cross section, but we do not know what they are. The only real way to determine this is to compare kilns on approximately the basis given in the table. When this is done, the stone also should be taken into consideration, because stone, and especially lime, conductivity varies; and also if it is too small, it will obstruct the draft, and if too large, the heat will not penetrate readily. In one case, for two weeks one kind of stone was burned, then for another two weeks stone from a different ledge in the same quarry was used, and after another two weeks the first stone was again burned, all in the same kiln. The difference was 50 bushels per day, mainly due to the white stone containing more spalls; in part, however, due to the fact that the white was less crystalline than the gray, which has an effect upon conductivity. However, if the draft had been increased when the white stone was burned, and a proportionately greater amount of fuel had been fired, the capacity would have been the same as with the gray stone. It is admitted that conditions will be different with different stones, but the blame placed on them is too great. They have not so great an influence on capacity when of the same chemical composition as has often been claimed.

Many who are told of the high output of kiln G, given in Table II, immediately ascribe the condition to the stone; but in that very plant they have kilns of an ordinary design using the same stone and producing the ordinary 11 tons of lime per day, only half of kiln G. They both have the same shaft area. It is not so much the stone as it is the kiln design and operation.

Recent Developments in the Production and Consumption of Abrasive Garnet

By W. M. MEYERS [1] and C. O. ANDERSON [2]

SINCE 1922, when a brief report on the production and utilization of garnet was issued by the Bureau of Mines, there have been a number of interesting developments in the technology of that mineral. Greater activity has been displayed in mining, new mills have been erected, and more attention has been paid to improvements in milling so that a more efficient and economical recovery of garnet has been possible. These activities have resulted in larger production; therefore, attempts are being made to broaden the market for garnet abrasives, and to find new uses for the unusual combination of physical properties than this mineral possesses. The writers have recently completed a field study of the occurrence, methods of mining and milling of garnet, and the manufacture and utilization of abrasive garnet products. This preliminary report indicates the most important sources of garnet, the method by which it is recovered, and the manner in which it is utilized.

Chemical and Physical Properties

The term "garnet" is applied to a closely related group of minerals which crystallize in the same forms and possess similar physical properties, although their chemical composition may exhibit greater variation. The chemical composition of the garnet group may be represented by the general formula 3R" O.R"' 203.3S1O_2, in which R represents the bivalent elements calcium, magnesium, manganese in the manganous state and ferrous iron. R"' represents the trivalent elements, ferric iron, aluminum and chromium in the chromic state. On account of the isomorphous substitution of the different bivalent and trivalent elements, specimens whose composition may be represented by a definite formula are rare; the composition of any given specimen generally exhibits great complexity.

The garnet group is composed of six species and their isomorphous mixtures; rhodolite which is said to exist in fairly definite proportions may be said to constitute a seventh species. These varieties of garnet are as follows: Grossularite, 3CaO, Fe_2O_3. 3SiO_2; pyrope, 3 MgO. $A1_2O_3$. 3SiO_2; almandite, 3FeO.$A1_2O_3$.3SiO_2; Rhodolite, which is a mixture of pyrope and almandite in the ratio of two molecules of pyrope to one of almandite; spessartite, 3 MnO.$A1_2O_3$. 3SiO_2; andradite, 3CaO Fe_2O_3.3SiO_2; and uvarovite 3CaO.Cr_2O_3.3SiO_2.

Specimens of garnet are customarily classified under the name of the variety whose chemical composition is most closely approached. The physical properties of garnet which are of industrial importance are cleavage, fracture, tenacity and hardness.

Cleavage: An indistinct dodecahedral cleavage has been observed in garnet in rare instances. Some species of garnet possess a pronounced laminated structure which provides planes of weakness along which the garnet separates. This is a mechanical parting and can not be considered a true cleavage as it is not related to the crystal form.

Fracture: The fracture of garnet displays great variation. In some varieties, particularly those possessing a glassy structure, it is perfectly conchoidal and the garnet tends to break in thin, shell-like flakes. In others the conchoidal fracture is less marked or disappears completely and the fracture is uneven.

Tenacity: Aggregates of garnet composed of many small individuals are brittle and shatter readily; massive garnet and well formed crystals exhibit a remarkable toughness and can only be shattered with difficulty.

Hardness: The hardness of garnet varies from 6.5 to 7.5 in Moh's scale. It has been stated that some specimens have displayed a hardness approaching 8.0. Sound crystallized garnet generally has a hardness of 7.5, and is therefore slightly harder than quartz which has a hardness of 7.0.

Occurrence of Garnet

The members of the garnet group are very common accessory minerals in a large variety of rocks, particular-

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ly in granites, gneisses and schists. They also occur in serpentines, peridotites and crystalline limestone. Most varieties of garnet are more resistant to chemical and mechanical erosion than the minerals with which they are associated, and for this reason often appear in the detritus of disintegrated rocks and in sand deposits.

On account of the large variety of rocks in which garnet is commonly present, the geographical areas in which it may be found are enormous, both in extent and in number. Concentrations of the mineral possessing the necessary qualifications for ornamental or industrial use, in deposits so located with regard to transportation and a market that they can be exploited commerically, are greatly restricted and occur in only a few areas. The comparatively small demand for garnet has resulted in a limited development of these deposits.

The Utilization of Garnet

Specimens of garnet possessing attractive color have been used for ornamental purposes since prehistoric times. The mining of gem garnet has never developed into a systematic, well-established industry in any one locality, and the demand for this material has been satisfied by the production of many small and scattered operations. The value of the gem garnet produced annually in the United States does not exceed a few hundred dollars. Garnet is employed as a jewel in the movements of cheap watches. Ruby and sapphire are preferred for this purpose as they possess a superior hardness.

The elements composing garnet are not of sufficient value to make their extraction profitable. Such a process would necessarily be difficult and expensive due to the stable nature of the silicates composing the garnet group. It is believed that only one attempt has been made to utilize the chemical composition of garnet. This has been described in Patent No. 1,192,-394 issued July 25, 1916. This patent describes a process for the manufacture of ferro-silicon and a highly aluminous abrasive from almandite garnet. This process was devised during a period when ferrosilicon was expensive and difficult to obtain owing to war conditions. It is doubtful if this process would be feasible at present, as ferrosilicon is abundant while garnet is too expensive and the supply hardly sufficient to maintain such a process on a commercial scale.

The Use of Garnet as an Abrasive.

The present activity in the mining of garnet has resulted from the recognition of its unusual abrasive properties. The bulk of the garnet produced for this market has been almandite. Rhodolite, pyrope and andradite have been utilized to a lesser extent. Deposits of the other varieties of garnet which could produce a commercial tonnage suitable for abrasive purposes are unknown. The marked lack of any regular cleavage, together with the manner of fracture, has an important effect on the shape of the grains of crushed garnet and thereby influences its industrial use. Although a great deal of garnet displays a laminated structure, which furnishes parting planes along which the garnet separates when crushed, this cannot be considered a true cleavage as there is no further tendency toward a regular parting when the garnet has once been separated into the plates formed by these laminations. The fracture of garnet used as an abrasive is irregular to subconchoidal with the result that when garnet is crushed, the grains are formed in irregular, many angled particles which are roughly equidimensional and suggest modified cubes or tetrahedrons which possess a multitude of sharp chisel-like cutting edges. As these grains are broken in use further sharp edges are produced, as garnet appears to have just sufficient brittleness to break under the strain of ordinary use rather than to polish down to a smooth surface.

The employment of garnet as an abrasive has been American in origin and first became of commercial importance about 1880, when the first operations in the mining of abrasive garnet were begun in the Adirondack section of New York. This was followed by the development of small properties in Pennsylvania and Connecticut, which for a time were the most important producers. These deposits were eventually exhausted, and production has since been centered in New York, New Hampshire and North Carolina.

NEW YORK

Garnet-bearing rocks occur over a wide area lying in Warren, Essex, and Hamilton counties. The garnet is present in fairly well developed crystals and also in large massive aggregates. Most of these rocks are gneisses and show evidence of having

undergone extensive metamorphism. The garnet content seldom exceeds 12 per cent, except in occasional large masses of aggregate containing as much as 60 per cent of garnet. Although these rocks are widely distributed, concentrations of commercial importance are not common and are found in comparatively few localities.

The present production of this district is limited to four companies, the North Creek Garnet Co., the Barton Mines, Inc., the Warren County Garnet Co., and the American Glue Co. In the past a number of small scattered mines have been worked irregularly, but none of these are active today.

The North River Garnet Co.

The quarry and mill of the North River Garnet Company are located on the eastern side of the Thirteenth Lake in Warren County about 10 miles from North Creek, the nearest shipping point. The gneiss quarried carries 4 to 8 per cent garnet in crystals having a maximum diameter of three inches. Hornblende and feldspar constitute the most important pangue minerals. The quarry is in a large projecting knob of gneiss, and has a maximum diameter approaching 300 feet. The jointed structure of the rock is highly developed, and the horizontal partings are utilized as the base of small benches in quarrying. The rock is drilled to a depth of 15 feet and the holes are sprung and then loaded with 60 per cent ammonia dynamite which is fired with a blasting machine. Large blocks are reduced by block-holding, and the broken ore is loaded either by hand or by steam shovels to quarry cars which run to the head of the mill, a maximum distance of 200 yards.

The milling consists essentially in liberating the garnet from the gangue minerals by stage crushing and its concentration by jigs. Harz and James jigs are used on the coarser sizes while the fines are recovered on vanning and pneumatic jigs specially designed for this purpose by Mr. F. C. Hooper. The final garnet concentrate is sacked and trucked to North Creek for shipment by rail. Part of the tailings are used for road construction.

The Barton Mines Corporation

The quarry of the Barton Mines Corporation is on Gore Mountain, about 11 miles by road from the village of North Creek. The most characteristic feature of the dark gray, massive rock is the garnet crystals themselves, which give the rock a porphyritic texture. Mineralization is simple, as hornblende constitutes nearly 40 per cent of the rock mass, the remainder being divided between orthoclase and plagioclase feldspars, pyrozene and mica. Small amounts of pyrite and magnetite are also present. The garnet content of the ore averages about 12 per cent and occurs in crystals of unusual size. Single crystals a foot in diameter are common and individual ones from 30 to 36 inches in diameter have been found. The crystals have a very pronounced laminated structure by which they are divided into plates from a sixteenth to a quarter of an inch in thickness.

The garnetiferous rock has undergone considerable alteration at the surface, and the first mining was in this oxidized zone from which the garnet could be readily recovered. Later, quarrying was started in the unoxidized rock, and with the erection of a modern concentrating mill in 1924, the quarrying was placed on a systematic basis. The quarry now consists of a series of open pits which are being developed into regular benches. Ten-foot holes are drilled with jackhammers and these are shot with 40 and 60 per cent gelatin. Boulders are block-holed with small charges of dynamite. The broken ore is loaded into three-ton cars with steam shovels and hauled to the mill with a gasoline locomotive. In breaking the ore in the quarry many of the garnet crystals are shattered. The largest fragments of clean garnet are picked and sacked for immediate shipment.

The ore is crushed in the mill to 0.5 inch before starting concentration. The material from 0.5 inch to 2.5mm is concentrated in a series of James jigs. The material finer than 2.5 mm. is treated on a combination of tables and single cell jigs. The finished concentrate is sacked and shipped from North Creek.

Warren County Garnet Mills

The Warren County Garnet Mills, Inc., operate a number of small scattered quarries in the vicinity of Wevertown and Johnsburg. The garnet ore is removed from shallow excavations, seldom exceeding eight feet in depth. The rock is drilled by hand with a single jack, blasted, sledged and hand picked, and trucked to the

mill. The garnet content of the ore going to the mill is high, varying from 30 to 60 per cent. The ore is crushed in the mill and screened to a number of sizes from 16 to 200 mesh. The sized material is concentrated on dry tables. The final concentrate is shipped in kegs to wood-working industries and manufacturers of abrasive.

The American Glue Company

A band of garnetiferous gneiss outcropping on Casey Mountain about five miles northwest of North River, N. Y., the nearest post office, has been operated by The American Glue Company and has produced a considerable tonnage of garnet in the past. In August, 1924, the mill was not active, and the only production was a small tonnage which was hand-cobbed and sacked for shipment at the quarry.

NEW HAMPSHIRE

The Wausau Abrasive Company

The mine and mill of the Wausau Abrasive Company is located in North Wilmot, Merrimac County. The garnet is present as numerous small crystals, ¼ to ⅜ inch in diameter, forming 40 to 50 per cent of the total rock mass. Feldspar and biotite mica are the most prominent gangue minerals. The quarry is approximately 180 by 100 feet with a maximum depth of 25 feet. Holes are drilled to a depth of 6 feet and shot with 60 and 75 per cent gelatin. Boulders are bulldozed, and the broken rock is loaded by hand into cars, which are hoisted up an incline. The cars are then trammed by hand to an ore bin on the hillside above the mill. The ore from the bin is fed to a jaw crusher which crushes to 1¼ inch. The crushed ore falls into a loading bin which loads the buckets of an aerial tramway. This tramway conveys the ore to the mill a distance of 1200 feet.

At the mill the ore is crushed to ⅜ inch and dried. The dried ore is passed through a series of screens by which products having the following dimensions are separated: minus2mm., plus 1.4mm; minus 1.4mm., plus 0.75 mm; minus 0.75 mm., plus 0.36mm; minus 0.36mm, plus 48 mesh. The sized products are stored in bins and treated alternately on two dry tables. Concentrates are sacked for shipment, middlings are returned to the feed and tailings are sent directly to waste. That portion of the feed which passes the 48-mesh screen is sent directly to waste as it does not contain enough garnet to justify treating it.

NORTH CAROLINA

The Rhodolite Company

The Sugar Loaf Mountain garnet deposit located two and one-half miles south of Willits, North Carolina, is being developed by the Rhodolite Company. In March, 1925, a new mill for treating the ores was nearing completion and preparations were being made to start quarrying. This deposit has been worked at intervals, and a considerable tonnage of garnet recovered in the past twenty-five years. The present activity is the first attempt to recover this garnet by systematic, large-scale operation.

The garnet occurs in small crystals, ⅛ to ½ inch in diameter, in a large body of mica and quartz-feldspar schist of unknown extent. The average garnet content of the rock is 20 to 25 per cent; local concentrations are as high as 60 per cent. The present quarry, which is a hundred yards up the valley from the mill, has been developed sufficiently to disclose a considerable tonnage of garnet ore. The ore is to be crushed in a 24 by 15 inch jaw crusher set at 3.5 inch, followed by crushing in a gyratory to three-quarters of an inch. The crushed ore will either be sent directly to a Ruggles Cole dryer or by-passed by a conveyor to an elevator which discharges it to a set of screens. The quarter-inch and 12-mesh screens will discharge their oversize to two sets of rolls, which are set to crush to ⅜ inch and 10 mesh respectively. The crushed product from these rolls is to be returned to the elevator and rescreened. The final products will be sized as follows: 10 to 18 mesh, 18 to 30 mesh, 30 to 50 mesh, 50 to 90 mesh, minus 90 mesh. Fifty-ton bins are provided for storage of each of these sizes. As the garnet does not tend to break into extremely fine particles, the minus 90 mesh material will be sent directly to waste. The sized products will be concentrated alternately on dry tables. The concentrate may be bagged and shipped directly as run-of-mill garnet, or sent to an electro-static separator which removes any pyrite and biotite mica present in the concentrate. The clean concentrate from the electro-static separator may be bagged for shipment or elevated to a set of rolls for crushing to smaller sizes

which are to be graded by a set of screens to final abrasive grain size. The run-of-mill from the dry tables may also be elevated to a Hardinge mill in closed circuit, with an air separator which will prepare a 200-mesh grinding powder suitable for the polishing of plate glass. A clean biotite mica concentrate may be prepared as a by-product in the operation of the mill if desired. It is estimated that the mill will produce 12 tons of concentrate per 10-hour shift from ore containing 20 to 25 per cent garnet.

Deposits of garnetiferous rocks are abundant in western North Carolina and a small, irregular production has been reported from several localities in Clay County. Garnet is also found in Madison County, and there is probably a large reserve of ore in these regions.

Deposits in Other States

Deposits of garnetiferous rock from which a supply of the mineral suitable for the abrasive market may be obtained, are known to occur in Georgia, Virginia, Montana, Colorado, and many other western states. The ore reserves of the active producers are sufficient to supply the market at the present rate of consumption for many years.

Foreign Deposits

Although many deposits of garnet are known to occur outside of the United States, little has been done toward their development. The foreign demand for garnet abrasives has been small, and the requirements of the American market could be met by the domestic producers most of the time without the assistance of any considerable tonnage of imports.

Spain

For a time an appreciable tonnage of abrasive garnet was produced annually in the Province of Almeria, Spain. This garnet is considered inferior to the standard American article, as it does not make as hard and sharp an abrasive, and the small size of the crystals increases the difficulty of obtaining the full range of sizes required for the manufacture of abrasive papers. In the early years of the development of the garnet industry when domestic supply was not equal to the demand, Spanish garnet was imported in amounts varying from 500 to a maximum of 3,000 tons annually. In 1924 the imports had dwindled to approximately 300 tons, and it is doubtful if there will be any further importation of the Spanish material in 1925, as domestic production exceeds the demand.

Canada

Many occurrences of garnet have been reported in Canada, some of which could supply a large tonnage. The most important are at Depot harbor on Parry Island, Ontario, in the townships of Ashby, Elzevir, Portland, Loughrin, Dill and Harcourt of the same province: at Chegoggin Point, Yarmouth, N. S., and in Rawdon and DeRamsey Townships, Quebec. Little has been done in the way of commercial development except at two localities, Depot Harbor and Ashby township.

A few tons of garnet ore have been mined at Depot Harbor, where prospecting disclosed an extensive ore body which was said to average 15 per cent garnet. Water transportation is available, and the erection of a mill for concentrating the ore has been considered.

The first appreciable tonnage of Canadian garnet was produced in 1923, by the Bancroft Mines Syndicate in Ashby Township, when 1250 tons of hand-picked ore and concentrate, valued at $100,000 were shipped to abrasive paper manufacturers in the United States. An average mill feed of 30 per cent garnet was obtained. The quarry has been carried 40 feet into the hillside, leaving a face 20 feet high. The extent of the ore body has not been accurately determined. Stripping for 150 feet along the strike disclosed uniform ore. The deposit is 15 miles from a railroad, the shipping point being Bessemer siding. This distance may be shortened by a new road. Hauling was done by wagon. The concentrator was destroyed by fire in the fall of 1923, and since then little mining has been done.

Production from other countries has been small, irregular, and comparatively unimportant.

The Assay of Garnet Ores

The determination of garnet is a difficult operation and one which does not permit a high degree of accuracy. On account of the complex composition of garnet and the minerals with which garnet is commonly associated, it is impossible to make any chemical

analysis by which the garnet content may be calculated. Resort to mechanical means is therefore necessary. Before garnet can be separated from its associates, the ore must be crushed fine enough to liberate the particles of garnet from adhering minerals. A weighed portion of crushed ore may then be picked by hand with the aid of a small pair of tweezers and a magnifying glass, and the garnet separated from the gangue minerals and collected so that it can be weighed and the garnet content of the ore calculated. This method is laborious, and accurate results can only be obtained by careful manipulation.

The assay of garnet ores may be facilitated by the use of heavy solutions. Although the range in specific gravity of the garnet group is from 3.4 to 4.3, these varieties of industrial importance have much closer limits, generally from 3.90 to 4.00. Except in isolated cases of unusual mineralization, the gravity of the associated minerals does not exceed 3.20. Obviously, a liquid having a specific gravity between 3.20 and 3.90 would float the gangue minerals, and the garnet would sink. By the utilization of such liquids the garnet content of a sample of crushed ore may be separated from the other minerals and the percentage determined. For this purpose few liquids are suitable. One of the most convenient is methalene iodide which has a gravity of 3.3. It is miscible in all proportions with benzol, gravity 0.88, which permits the preparation of liquids of lower gravity when desired. Klein's solution, a solution of cadmium-borotunstate in water, with a gravity of 3.28 may also be employed. A solution of tallium-silver nitrate is also useful. This substance, made from the nitrates of the two metals melts in the range of 65°—80° C., depending on the relative amounts of the two metals present. This substance has a maximum specific gravity of 4.8 and by diluting with water practically any gravity between 1 and 4.8 may be produced.

The preparation of heavy solutions is rather expensive and their use has been limited in consequence. Accurate methods of sampling and assay have seldom been employed in the garnet industry, the garnet content of a deposit being determined either by the estimate of an experienced man after careful examination or by determining the percentage of garnet recovered by milling and concentrating a small experimental tonnage.

Production of Abrasive Garnet

The production of abrasive garnet in the United States since 1914 is as follows:

Year	Short Tons	Value
1914	4,231	$145,510
1915	4,301	139,584
1916	6,171	208,850
1917	4,995	198,327
1918	4,696	248,161
1919	4,944	310,131
1920	5,476	434,425
1921	3,048	260,887
1922	7,054	566,879
1923	9,006	688,437
1924	8,290	674,176

(Figures from the U. S. Geological Survey.)

The Marketing of Abrasive Garnet

Producers of garnet generally ship their product as unsized concentrate in 100-lb bags which are quoted at a price per net ton f.o.b. shipping point. In April, 1925, garnet was quoted as follows: Domestic Adirondack $85 per ton, Canadian $70 to $80 per ton, Spanish $60 per ton, c.i.f. point of entry.

There is a tendency among producers of garnet to install grading equipment at their mills so it may be expected that in the future the consumer will be able to buy any desired size directly from the producer.

The adoption of garnet as an abrasive for the grinding of plate glass has resulted in a demand for a grinding powder as fine as 200 mesh. In order to meet this demand the producers have, in several instances, added suitable grinding equipment to their mills. Sized garnet grain is sold by the pound, the price depending upon the quality of garnet and the size of grain.

The Manufacture of Garnet Abrasives

Approximately 90 per cent of the garnet production is manufactured into surface coated abrasives. The crude garnet is crushed and graded accurately by screening into a number of products varying from 20 to 200 mesh. In the grading of garnet very accurate sizing within close limits is demanded. The crushed garnet is quoted on either paper or cloth

backing. Manila fiber or rope paper is used for the best quality of garnet paper. Kraft paper is employed for the cheaper grades. Drills, jeans or twills are used for cloth backings. Large rolls of these backings pass continuously through a rotary press which prints the manufacturer's name and the size of the abrasive at regular intervals on the reverse side. The backing then passes between two rolls, one of which revolves in a trough of glue by which a film of the adhesive is spread over the surface. It then passes beneath a hopper which discharges a shower of garnet grains upon the glued surface. The excess garnet is shaken off and the cloth or paper dried. After drying a second "sizing" coat of glue is run over the garnet coated surface to fix all the garnet grains firmly in place. The garnet proper is then wound into rolls which are later cut into standard sized sheets or fabricated into belts or discs suitable for the varying demands of industry. A non-clogging paper has been introduced on which the garnet grains are scattered mechanically so that a small space exists between each grain and those surrounding it. Special waterproof papers are also prepared by substituting for glue an adhesive which is insoluble in water.

Utilization of Garnet Abrasives

There is scarcely a woodworking operation in which a smooth surface is desired that garnet paper is not of value. It is particularly adapted for working hard woods and similar substances. Some difference of opinion exists concerning the conditions in which the superiority of garnet over quartz paper is most marked. In abrading soft, resinous woods, garnet and sand papers appear to be almost equal in efficiency, as both are soon clogged and must be discarded. Reports concerning the effectiveness of garnet paper on hard woods vary with local conditions, but indicate that garnet will cut from two to six times as much wood as quartz, whether measured by weight or by area of the surface abraded. It is most valuable in the finishing of the highest class of furniture, pianos, phonograph and radio cabinets, and it is also used extensively in the manufacture of wagons, automobiles, boats, railroad cars, and for the smoothing of handles, floors and mill work of all descriptions. Garnet paper for metal working is sold to manufacturers of a variety of machines, automobiles, electric appliances, brass specialties and metal furniture. In these industries it is used for cleaning castings, grinding valves and surface finishing. In the manufacture of boots and shoes, garnet paper is used for scouring the heels and soles. It is also used in repair shops for finishing the heels and soles to final size and smoothing the edges.

The special uses of garnet paper are varied. It is used to finish rubber, bakelite, and celluloid; to clean wooden and composition floors and other materials where vigorous scouring is desired. The fine papers are employed in the finishing of felt and silk hats and also as an abrasive in dental work. It is commonly used to remove and rub down paint and varnish on both wood and metal surfaces.

Since the introduction of garnet for the grinding of plate glass in 1914, there has been a gradual but constantly increasing demand from this market. The garnet is used for the fine grinding just before polishing and therefore must be prepared as a fine powder.

Future Development of the Garnet Industry

The present condition of the garnet industry indicates that a greater utilization of this mineral may be expected in the future. In the year 1924 the industry has undergone its greatest expansion with the erection of new mills in New York and North Carolina. The potential production of the mills now in construction is estimated to be in excess of 20,000 tons annually. The annual consumption in 1924 being in the vicinity of 9,000 tons, it is natural to expect that attempts will be made to broaden the market and find an outlet for the excess production.

Some of the present markets for garnet are capable of considerable expansion. The use of garnet in the plate glass industry is limited. If the practice of fine grinding with this material should become universal, an additional demand for several thousand tons annually is possible. The use of abrasive garnet has been American in origin and has been adopted by other countries only to a very limited extent, and export business

has been practically negligible. The introduction of garnet products into the industries of foreign countries, particularly the wood, metal and leather working of Europe, should provide an outlet for a considerable tonnage.

The possibility of using garnet in new fields has been the subject of some investigation. Garnet grains have been used for facing tile and concrete blocks; besides being ornamental, the garnet presents a surface having great resistance to wear. The substitution of garnet sand for quartz sand in sand blasting has been advocated. The expense of the garnet is considerably higher than for quartz, and it is only to be used where its superior abrasive qualities are of value and conditions permit the recovery of the used grain.

A possible quantity market exists in the surfacing and polishing of the softer ornamental stones such as marble, slate and serpentine. Very large tonnages of these stones are cut annually into thin slabs which are used for floor surfacing, wall panelling and architectural work. Blocks of marble are sawed into slabs with gang saws which consist essentially of strips of steel which are supplied with water-borne sand. The actual cutting is done by the sand being dragged against the marble surface by the steel blade. It has been stated that if an abrasive could be made available that would cut three or more times as fast as sand, and not cost more than ten times as much per ton;—or if its lasting qualities were proportional to its higher price in case it were very expensive, the cutting of marble would be greatly facilitated. The possibility of garnet meeting these requirements can only be determined by actual use.

Traylor Crusher Bulletin

The Bulldog Jaw Crusher, its development, construction details, specifications and capacities are extensively discussed in Bulletin No. 1099, superseding No. 99, which has been issued by the Traylor Engineering & Mfg. Co., of Allentown, Pa. The Bulldog, it is claimed, has demonstrated very positive superiority in the jaw crusher field, and is esteemed by owners for the high efficiency and low cost of operation and maintenance it displays in action.

In order to secure "the best possible frame," semi-steel was adopted for the material, instead of using one piece cast steel frames, for cast steel frames, "though somewhat stronger, are much more expensive," they say. Other features are:

1. The Pitman, rod type, but lighter and stronger than the old Blake design.
2. The Toggle System, with three bearings instead of four, and with a Rolling action instead of the old knuckle motion, whereby frictional loss is reduced.
3. The Pitman Shaft or Eccentric Bearings, of the ball-and-socket type, which constitute an automatic self-aligning feature.
4. Saving of Power and Maintenance Cost by elimination in weight and friction of the Pitman, Toggle System and Eccentric Bearings.
5. Ready Accessibility of all parts, due to shape of frame in the rear, permitting frequent inspection and ease in making repairs.
6. General Sturdiness of Design, which provides mass for the absorption of operating shocks and increasing the machine's efficiency.

The bulletin describes and illustrates in detail the Traylor Bulldog Jaw Crusher, and contains other information which it is believed will be found useful by the operator.

A New Osgood Bulletin

A new bulletin on the Osgood ¾ yard Power Shovel—Bulletin 256—has just been issued by The Osgood Company of Marion, Ohio. This machine has recently been placed on the market and according to the manufacturers has met with remarkable success.

The Osgood Power Shovel is a ¾-⅞ yard machine, full revolving, mounted on continuous treads and powered by gasoline engine, oil engine or electric motor. It is readily converted to a crane or to a clamshell or dragline excavator by substituting the proper boom and bucket.

Great simplicity of design, rugged construction throughout, ready accessibility, easy working controls,—these are said by the manufacturers to be a few of the features of the Osgood Power shovel.

An Efficient Scraper Operation Producing 800 Tons Daily

The Mahoning Valley Sand Company Operates Flexible Plant Equipment Installed To Permit Coordination of Production

OPERATING a deposit of 130 acres of approximately 50-50 sand and gravel of exceptionally good quality ranging from 50 feet to an unknown depth with stripping necessary from 6 to 10 inches in depth with a well built and very well equipped plant happens to be the good fortune of the Mahoning Valley Sand Company.

This company was incorporated in March, 1924. They installed their plant with new equipment throughout. A Sauerman 2 cubic yard Crescent power drag scraper operated by a Sauerman special scraper electric hoist equipped with a 75 H.P. motor drags the material from the deposit onto a grizzly. This hoist has a load line speed of 200 feet per minute and a back haul speed of 600 feet per minute. This speed is a big factor in maintaining an output of 800 tons per ten hour day. On a haul of 200 feet the scraper can maintain an hourly capacity of 100 tons which is about 20 tons in excess of the capacity of the screening plant. On a haul of 300 feet, which is as far as the scraper will be operated, a capacity of 80 tons an hour can be maintained. This is equal to the capacity of the screening and washing plant. When the haul exceeds 300 feet the field hopper will be moved out into the pit and the present belt conveyor extended. In this way the scraper will be able to haul enough material for or more than the capacity of the screening and washing plant.

The scraper discharges its load onto a grizzly through which the

View Showing Scraper Discharging Onto Bar Grizzly

material drops to a hopper with a capacity of 12 cubic yards. The material is fed from this hopper by a reciprocating feeder, driven by a 7 H. P. motor, to a Link Belt 6 ply 24 inch rubber covered canvass belt 350 feet centers which runs up an incline on 72 carriers discharging the material at a height of 56 feet above the field hopper directly into screens. A 20 H.P. motor drives the belt.

Link Belt "Dull" conical screens, mounted on the same shaft that is driven by the 20 H.P. belt conveyor motor, separate the sand and gravel into five sizes. The oversize which is everything larger than 2¼ inch is run to a crusher and returned to the screens by a 60 foot belt conveyor. The screens produce gravel 2¼ to ⅜ inch, gravel 2¼ to 1¼, gravel 1¼ to ⅜ inch, and sand from ⅜ to ¼ or 3-16 inch, as desired. Link Belt 72 inch conical sand separators are used for washing the sand. The finished material drops to bins. The material is either loaded directly to cars from these bins or conveyed to a platform from which the material is loaded onto stock piles by a derrick equipped with a 1¼ yard Hayward clamshell bucket operated by a hoist driven by a 50 H.P. motor.

Water is supplied for washing by three pumps. One of these pumps is driven by a 15 H.P. motor and delivers a 3 inch stream. Another is driven by a 10 H.P. motor and delivers a 2 inch stream, while the third pump is driven by a gas engine and supplies a 1¼ inch stream of water.

While the Mahoning Valley Sand Company have been operating since 1914, they did not incorporate until March, 1924. Mr. R. B. Cowher, is president and Mr. Earl Chidlen is vice president. Mr. R. C. Zell is secretary-treasurer.

The material is produced for a market in highway construction, building construction and concrete blocks. The storage bins, of which there are three, have a capacity of 60 tons each. The company has 2000 feet of railway siding and rail shipments are made over the Baltimore and Ohio Railroad and the Buffalo, Rochester and Pittsburgh Railroad.

Mr. Leon Thomas and Mr. Genot of the Andre Citreon Company of Paris, have recently spent a week with the Miller-Hurst Corporation, General Motors Building, Detroit, in consultation on the new Andre Citreon Foundry. The Miller-Hurst Corporation did the preliminary engineering work on the Andre Citreon Foundry which is one of the largest outside of the United States.

Mr. Thomas is Vice President of the National Engineering Society of France and is also Chief Engineer of the Andre Citreon Company. Mr. Genot is the New York representative of Andre Citreon.

View of Pit Showing Conveyor Belt From Field Hopper

Blasting Practice in Quarry And Open Pit Mining

Written Expressly for Pit and Quarry, By R. N. Van Winkle

Part IV.

This is the fourth of a series of six articles. The first appeared in the June first number of PIT AND QUARRY. In the first article Mr. Van Winkle discussed the action of explosives, kinds of explosives, selection of explosives and amount of explosives to use.

In the second article, which appeared in the June 15th number, the size of cartridges, explosive costs, and methods of figuring the shot were discussed.

In Part III drilling, locating and loading practices as applied to quarry and open pit mining were discussed.

Readers are invited to correspond with Mr. Van Winkle in relation to these articles or to blasting problems in general. The editor of PIT AND QUARRY will be pleased to receive comments or data on this subject from readers whose experience and knowledge will be of value in the study of blasting practice.

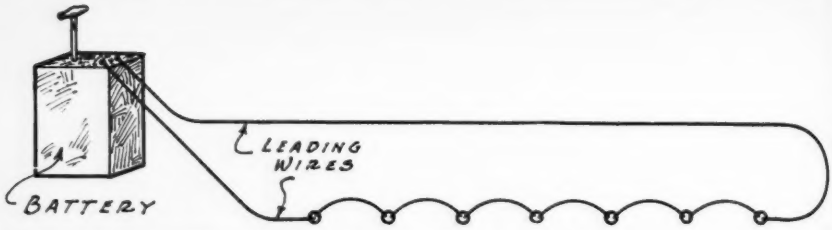
Editor

Firing

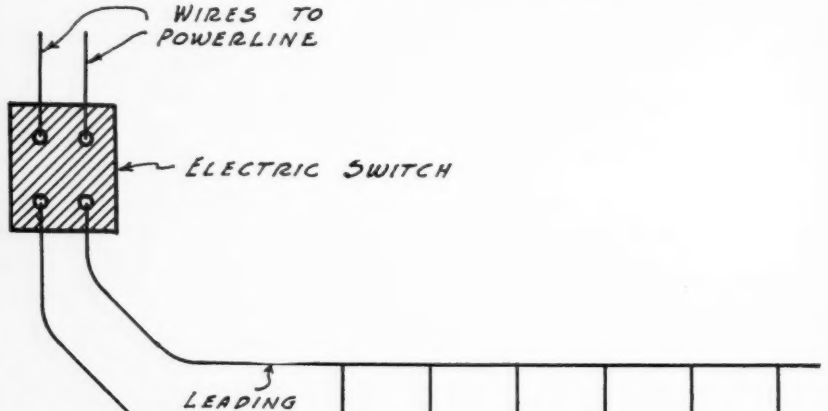
The firing, setting off, pulling or detonating, which are common terms used, of a blast or explosive charge is ordinarily accomplished by one of four methods; squibs, caps and fuse, electric cap or exploder, or Cordeau. As a rule miner squibs or electric squibs are very seldom used in open pit or quarry operations, so no treatment of them will be attempted. Before taking up the question of firing, the question of size of shot to be loaded and fired should be given some consideration.

An excellent policy in bank shooting is always to pull or fire as many holes as possible. By the word, many, is meant counting along the face or along the length of a face. This method saves adjacent holes, for as a rule the first and perhaps the second hole next to a shot will be lost or spoiled on account of cave in or bank sliding, making it impossible to load these holes at a future time. It furthermore eliminates tough, hard ground, which doubtless every operator has experienced, at a point between two shots, as it is almost impossible to make two separate and distinct shots properly overlap and properly fragmentate the round between them.

The method to be used in firing a shot is regulated by the work in hand. All three methods doubtless have their particular advantages under certain conditions. When the fuse and cap method is used, the fuse should be cut amply long to permit time for the blaster or shot firer to gain a safe distance from the blast before the explosive goes off. Unquestionably all handlers of explosives are familiar with cutting and crimping of blasting caps onto the fuses, but splitting the end of the fuse to be lighted to expose the powder train will permit easy lighting and is quite universally practiced. While the fuse may be lighted with matches, a torch or almost any sort of fire, an iron carried in the hand of the blaster or shot firer previously heated to a red heat is the simplest means of lighting fuses. This iron can be thrown or dropped after the lighting has been done, and by this method cannot be damaged and is ready for use again after being reheated. Where electric blasting is decided upon, this means of firing is accomplished by the use of electric blasting caps, possibly better known as electric exploders, and an electric current. Electric current may be obtained from push or pull batteries especially designed for this class of work, or taken directly off a lighting or power line. When shooting off a lighting or power line either alternating or direct current can be used; and while 40 cycle alternating current is the lowest electric current recommended by explosive manufacturers, the writer has used successfully electric current as low as 25 cycle. How much lower than 25 cycle can be used successfully is problematical. In electric firing there are several methods of connecting up shots or connecting up electric exploders to be detonated. Following are typical examples of three of the most commonly used connections.



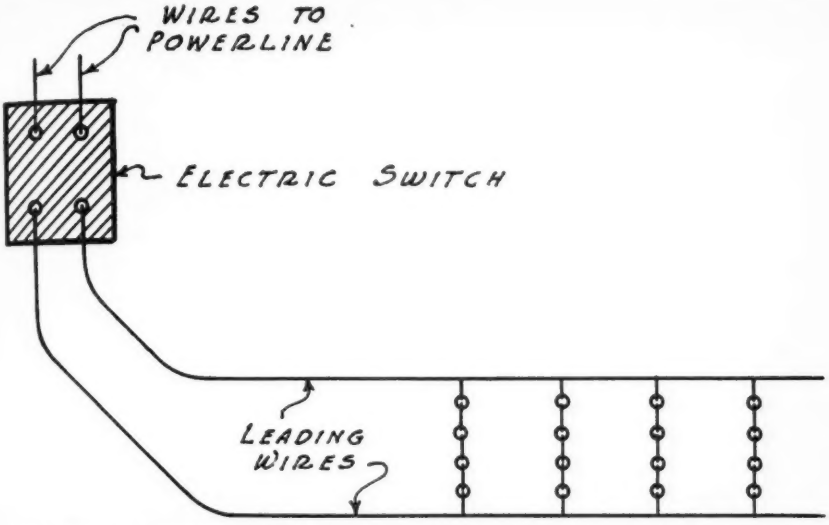
The above is a typical example of a series connection and is the only one that can be used, or is recommended to be used in conjunction with a blasting battery.



The above is a typical parallel connection and can be used with a power or lighting circuit, or blasting battery, a power or lighting circuit being preferable.

The use of Cordeau as a firing agent is particularly adapted to bank shooting where large sized bore holes are used and a considerable amount of high explosives is to be fired. Cordeau is a specially prepared lead tube filled with Trinitrolouene having a rate of detonation of approximately 17,500 feet per second. It is also claimed that Cordeau will increase the effectiveness of the less sensitive explosives from 10 to 15 per cent and is especially valuable where the loadings of dynamite in bore holes are broken or separated by stemming, as it assures detonation throughout the entire length of the bore hole. The use of Cordeau, owing to its cost per foot, is almost prohibitive in shallow holes and also prohibitive in deep holes where small charges of explosives are to be fired.

Owing to the fact that there has been some question in the minds of explosive manufacturers and users of explosives as to the use of electric current of less than 40 cycles, the writer feels that it is not out of place to give the experiences encountered with the use of 25 cycle alternating current. At first the standard parallel connection as shown in Figure "A" was used, but it was found upon throwing the switch that holes misfired indiscriminately throughout the shot. However, by reconnecting the lead wires and throwing in the switch again, every hole was fired eventually, but only after numerous attempts. On the other hand, another shot was connected up in a like manner, and no misfires occurred. Since an absolute check of all splicings, connections, electric exploders and so on had been made, it was eventually decided that the irregularity was due to the fact that the cycles, in 25 cycle current, which was what we were using, were so slow that it was possible to have thrown the switch when there



The above is a typical parallel series connection and is recommended to be used only in conjuction with a power or lighting circuit.

was anything from 0 to 220 volts, or any intermediate voltage on the line. It depended entirely on the voltage on the line as to the number of holes pulled or fired in the shot. To remedy this the parallel method of connection was continued, but one lead wire was reversed as shown in Figure "B." By this method, unless there is voltage enough on the line when the switch is thrown in to pull or fire all the holes, no one hole will be fired. This method of connection is an improvement over the standard parallel connection and is to be recommended. It might be well to state that the 25 cycle current referred to was 220 volts, 377 amperes, 3 phase.

Every known rule should be followed in preventing accidents in firing operations. Prevention is the first step in protection. Every electric cap or exploder should be tested with a galvanometer before and after it has been placed in the primer cartridge and again after the hole is loaded, stemmed and tamped. Then the entire circuit should be tested by the same instrument before firing.

Electric exploders or caps are made and carried in stock with copper wires of the following lengths: 4, 6, 8, 10, 12, 14, 16, 18 and 20 feet lengths.

Exploders, however, with longer length wires are furnished on special order. Electric exploders, caps or detonators, as they are sometimes re-

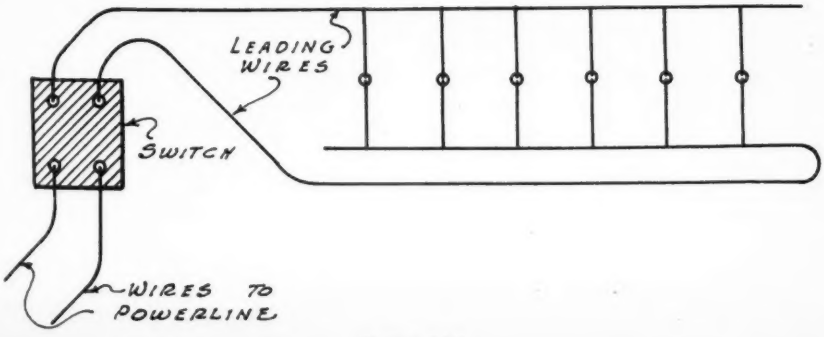


Figure "A"

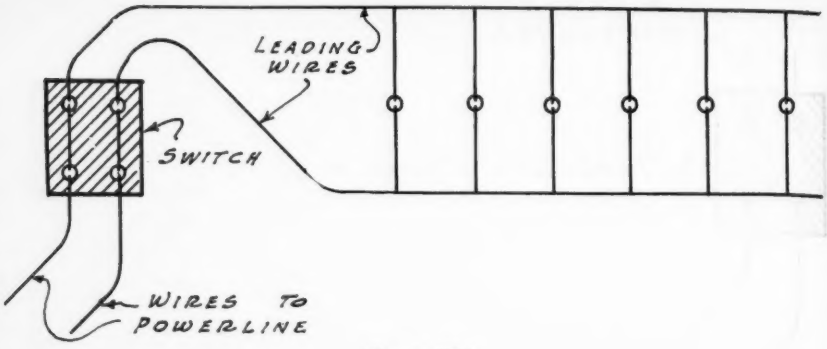


Figure "B"

ferred to, can be procured with two different and distinct colors of wire coverings, if desired, and this difference in color will help to keep the wires separated and distinct in making connections. Different colors or wire wrappings will prevent the connecting of the two wires from the same exploder to the same leading wire, thereby preventing a short circuit. In the case of several exploders being placed in one drill or bore hole, by having different colored wire wrappings it is a simple matter to keep the wires separated for connecting purposes, due to their color. While Number 14 wire is recommended for leading wires and Number 20 for connecting wires, the writer generally uses Number 18 common bell or annunciator wire in two colors as connecting wire and Number 8 weather proof wire as leading wires, the use of which gives perfectly satisfactory results. It is economy and good practice to tape with common friction tape all joints where wires are spliced or bare, to prevent leaks and short circuits. The elevating of the leading wires entirely off the ground, suspending them on empty wooden dynamite cases left after loading the shot, is recommended. In using the electric method of firing or detonating it is amperage, not voltage of electric current that should be looked to. An ampere is the practical electric current strength that one volt of electromotive strength can deliver through 1 ohm of resistance. It is an easy matter to determine amperes of electric current available and voltage on any power circuit, then figure the resistance of the leading wires to the shot and the resistance of the electric caps or exploders together with their wires. For convenience in figuring resistances the following tables are given.

In the table given the resistance of the electric cap or exploder is included, which is 1.10 ohms, while each foot of double (2 wires) has a resistance of .032 ohms, which is also included. If proper calculations are made, the total resistance of any shot can be figured in ohms from the data available and outlined. For each ohm of resistance in the circuit there will be required 1 ampere of electric strength to do the job successfully.

Misfires, or troubles encountered with electric shooting or detonating are too often blamed upon the electric exploder, battery or electric current, when the truth of the matter is that failures are almost always traced to carelessness on the part of some worker. The human element in blasting is a big factor to be reckoned with. It is sometimes thought that the amount of current passing through an electric blasting cap will have some effect on the force of the explosion, but this is not a fact. The amount of current passing through an eletcric blasting cap has no effect whatever upon the force of explosion. The amperage of electricity required for firing one electric blasting cap is actually 6-10 of an ampere. It is necessary, however, in order to insure the simultaneous firing or detonation of a number of blasting caps connected in series, using either alternating or direct current, to provide at least 1½ amperes for each series. This amount of current is sufficient for whatever number of electric blasting caps may be in one separate series; but when more than one series is connected in parallel in the same

circuit, at least 1½ amperes should be provided for each series. To ascertain the voltage necessary to send this amount of current through the circuit of electric blasting caps, multiply the resistance of electric caps as given in the "Table of Resistance in Ohms for each Electric Cap with Various Lengths of Copper Wires," as previously given, by the number of electric caps in the series and also by 1½ amperes. The result will be the voltage required. For each added series of electric blasting caps 1½ amperes more current is required, but no higher voltage.

Both blasting batteries and power circuits have a limit as to the number of holes or electric caps that they can carry or fire successfully, while by the use of Cordeau a greater number of holes can be fired with a greater degree of certainty. The actual firing of any shot or blast quickly demonstrates without question the thoroughness of the previous operations of drilling, loading, selection of explosives, amount of explosives loaded per hole and, in fact, the thought, or lack of thought or carelessness in the particular blast.

It is ordinarily a hard matter from an immediate visual inspection of any large bank shot to decide with any degree of accuracy whether proper fragmentation of the ground has been accomplished or not. In many instances the surface or top of the shot may look excellent; but upon digging into it with a steam shovel, tight bottom or toe may be encountered. It is a good idea not to be too enthusiastic over the good work resulting from any large shot until after the steam shovel has worked entirely through it, as tight bottom or toe may be encountered. One thing that can be learned from a visual inspection is whether or not the back break is unusually large. In case it is, look with suspicion upon the success of the blast; for if back break is unusually large, it is fair to assume, from experience, that the toe has been left. The accompanying photograph shows back break which is evidenced by the crack in the ground in the forepart of the picture, and while not extremely large is evidence of toe at the bottom of the bank shot.

The writer has witnessed many peculiar things in watching shots pulled or fired and in some instances very humorous things have occurred. In

Table of Resistance of Copper Wire in Ohms Per 1000 Ft. of Wire

Wire	Ohms
No. 8 Browne & Sharpe Gauge	.6271
No. 10 Browne & Sharpe Gauge	.9972
No. 12 Browne & Sharpe Gauge	1.586
No. 14 Browne & Sharpe Gauge	2.521
No. 16 Browne & Sharpe Gauge	4.009
No. 18 Browne & Sharpe Gauge	6.374
No. 20 Browne & Sharpe Gauge	10.14

Table of Resistance in Ohms for Each Electric Cap with Various Length Copper Wires

10 Ft. Length of wire	1.500 Ohms Resistance
12 Ft. Length of wire	1.608 Ohms Resistance
14 Ft. Length of wire	1.679 Ohms Resistance
16 Ft. Length of wire	1.727 Ohms Resistance
18 Ft. Length of wire	1.803 Ohms Resistance
20 Ft. Length of wire	1.857 Ohms Resistance
22 Ft. Length of wire	1.913 Ohms Resistance
24 Ft. Length of wire	1.970 Ohms Resistance
26 Ft. Length of wire	2.030 Ohms Resistance
28 Ft. Length of wire	2.093 Ohms Resistance
30 Ft. Length of wire	2.158 Ohms Resistance

making or firing a shot by any method, misfires are possible, but rarely probable if properly handled. Misfires are to be guarded against, as they are dangerous things to cope with. There are laws in several states which forbid the digging out of stemming or explosive charges from a hole that has failed to explode. There is no safe method that can be recommended for the handling of a charge of dynamite or explosive that has misfired, but sometimes the stemming is removed by digging it out and inserting another primer cartridge with additional exploders on top of the charge. Water is sometimes used for washing out the stemming as is also compressed air for blowing it out. It is to be hoped that misfires can eventually be entirely eliminated, but in handling them greatest precaution should be exercised to prevent what might be a tragedy.

Coyote—Gopher or Tunnel Method

The tunnel method of blasting is nothing new as might be supposed, but on the contrary is one of the oldest where large quantities of rock are to be moved, and has been employed for years in our western country. This method of blasting, sometimes referred to as coyote or gopher method, is in reality nothing more than the snake holing method on a big scale. While particularly adapted to extremely high banks or miniature mountain work, it should not be adopted if well drilling methods are

at all possible. There is unquestionably more element of chance in obtaining satisfactory results with the tunnel method of blasting than with the well drill and bank method of shooting. This method of attack in shooting ground as a general rule is resorted to in heavy side hill cuts where banks are exceedingly high and where the contour of the top of the bank is broken and uneven, which conditions make it almost prohibitive, from the standpoint of expense, to move heavy drilling machinery to the location and to economically move it from one hole to another owing to the unevenness of the ground or top of bank. There is very little question that by this method of blasting ground can be broken for a smaller total cost than by any other method. It is particularly adapted and low in cost in producing break water and rip rap, or stone of large irregular dimensions and for breaking up ground to be wasted in grading for railroads or highways. The tunnel method of shooting gives the most economical results where the ground has vertical instead of horizontal lines of cleavage; where it is not too seamy and where the ground appears in more or less of a solid mass or unbroken formation. Where the ground appears as having horizontal planes, this method of shooting is not the best, being more expensive than other methods and furthermore, attended by too great hazards.

In bank shooting operations where well drill or churn drill holes are used, straight banks and more or less even back break can be maintained, which are advantages especially in steam shovel loading. This maintaining of a straight bank or face and more or less even back break is, however, not possible as a rule in the tunnel method, owing to the fact that in the tunnel method of operation the explosive charges are of necessity placed in the extreme lower part of the bank and the resulting action is the throwing out of the bottom of the bank, allowing the overlying ground to fall and slide, relying on the falling and sliding and grinding action for fragmentation. Where back breaking and side breaks and irregular faces are not objectionable the tunnel method is as a rule satisfactory, providing all other conditions are carefully weighed.

For successful and economical tunnel blasting the bank to be shot should be about equal to the average height over the main tunnel or preferably higher than the length of the main tunnel. Ample consideration should be given the upper ledges or strata as to whether proper fragmentation can be obtained. As in bank shooting where well drill holes are used, careful thought must be given to the selection of the explosive to be used, whether a heaving or shattering action is desired and if the former, black powder or granular dynamite, generally called R.R.P., or Judson, should be used. If a shatter-

View Showing Back Break

ing action is required, dynamite is to be recommended.

According to the best authorities on the tunnel method of shooting or blasting the ideal tunnel to be used should be approximately 2-3 as long as the face or bank is high; but where only one cross-cut is used, to make sure of the toe of the bank being shoved out clear and properly broken, the main tunnel should be limited to about 60 feet. It must be borne in mind that local conditions absolutely regulate the practice to be followed in the tunnel method as well as in the well drill or churn drill method. While generally more economy and better efficiency are assured from one tunnel and single cross-cuts where banks are extremely high and explosive costs are not a factor, longer tunnels and numerous cross-cuts may be successfully used depending upon the amounts of material or ground to be shot and the conditions of the quarry face.

As with other methods of shooting or blasting, no definite rules can be laid down to cover all conditions, as it is a rare thing where conditions are alike in any two places. In the tunneling method it is more difficult, if anything, to be able to figure anywhere near accurately the amount of tonnage or yardage to be displaced in any one shot or blast; therefore the amount of explosives to be used is more or less a matter of guess or a matter of very rough computing. Data available, as to the fair average of tons of stone to be displaced per pound of explosives, vary considerably, ranging from 2½ to 6 tons per pound of explosives charge. This variation is doubtless due to the method followed in figuring the displacement, some figuring the actual section included by the main tunnel and cross-cut sand vertically over them, and others including the material displaced by back and side breaks. The displacement included in the main tunnel and cross-cuts and vertically over them is often termed, "the yardage in the square of the shot." As a usual thing a tunnel blast will break down almost twice as much yardage as is contained in the square of the shot. One authority on the tunnel method of shooting recommends that a fair average is to load approximately one pound of low strength and slightly smaller amounts of high strength dynamite per cubic yard of ground to be shot, while if black powder is used, 1½ pounds per cubic yard are recommended. This is where no consideration is given to back or side breaks. Other authorities claim from ½ to 1½ pounds per cubic yard if the ground is to be handled for crushing purposes, and from 1½ to 3½ pounds where it is desired to waste the material by throwing it clear of the right of way in railroad or highway construction. While the writer does not believe in extremes, it is probably better to use ample explosives to do the work rather than err in underloading in tunnel shooting. In the loading or placing of the explosive charges in the tunnel method the latitude in so placing is not as great as where well drill operations are followed. In well drill operations by stemming and breaking of charges, the explosives can be placed where desired, but in the tunnel method the entire charge of explosive is of necessity placed in pockets in the cross-cuts, often referred to as "T's," as no explosive is ever placed in the main tunnel in the lower or bottom of the bank.

The location and sizes of pockets are determined by experience and by the strength or grade of explosives adopted. As a usual thing low strength explosives require fewer, but bigger pockets than high grade explosives. Good practice in locating pockets is to locate them 1 foot below the cross-cut floor for each 10 feet of burden in floor of the pocket and make the pocket by drilling and sinking below the cross-cut floor a hole or pit large enough to contain the charge of explosive. Some authorities do not recommend this practice but place the explosive charge directly on the cross-cut floor. The latter method, the writer does not feel is as effective as the former. The size of the main tunnels and cross-cuts is a matter of choice, due consideration being given to local conditions and equipment available for driving the tunnel. The size referred to as "Wheel Barrow," being about 3 feet wide and approximately 5 feet high, seems to have many things in its favor from the standpoint of drilling, mucking, loading and back filling. The approximate cost of driving tunnels of this size ranges from $2.50 to $5.00 per running foot, local conditions governing.

The method of firing or detonating used for explosives in tunneling is exactly the same as that employed in bank shooting where well drill holes are used. Electric blasting caps or Cordeau are the accepted firing agents with preference given to electric blasting caps owing to the fact that the leading wires can be run along the top of the tunnel entirely out of the way and need very little, if any, protection when back filling. While tunnel shots can be fired with the ordinary blasting battery, still a power circuit is preferable. It is to be recommended that 3 electric blasting caps or electric detonators be put in each charge of explosive, and it is good policy to use not less than 40 per cent dynamite as a primer cartridge. When black powder or granular dynamite is used, 5 to 20 per cent of the total charge should be dynamite used as a priming charge, which for good results should be placed in the center. It is a matter of choice when using dynamite whether to remove the cartridges from the cases or leave them in the original package, as both methods are practiced. Where powder is used in a side hill tunnel shot made for the purpose of wasting material as above mentioned, it is considered best to open the kegs and pour the powder out in the pocket. Where Cordeau is used, it is a fine idea to run the main line of Cordeau through the main tunnel and cross-cuts and back out again permitting the use of 2 cans. 1 on each end of the Cordeau outside of the face of the bank as a protection against misfires.

Tamping operations are similar in a general way to bank shooting. The pockets are covered and the cross-cuts are filled with material accumulated in driving the tunnel and tamped solidly in place. Quite often logs and even a lean mix of concrete are used as bulk heads to assist in the confinement of the explosive action.

Benching Method

The benching method of quarrying in open pit quarry operations, from a shooting or blasting standpoint, does not employ knowledge or practices different from those applied to the ordinary bank operations. Benching methods are quite often resorted to where the face of ground to be worked is moderately high and too high to be worked in one lift or one face and is ordinarily the working of a series of faces in a series of steps, the depths of which are governed by the natural seams. These steps vary from 15 to 30 feet or more, according to the natural seams. In some benching operations the upper benches of ground are purposely blasted hard enough to throw them to the quarry floor where the material is loaded, but in some instances loading operations are carried on at each level or bench. The practice applied to bank shooting as previously covered will in practically every instance apply to bench operation.

The Lapeer Trailer Corporation announces the appointment of Mr. L. M. Bovaird as Manager of the Detroit Branch. The Lapeer Trailer Corporation manufactures a complete line of semi-trailers. Mr. Bovaird was formerly Branch Manager for the Mason "Road King."

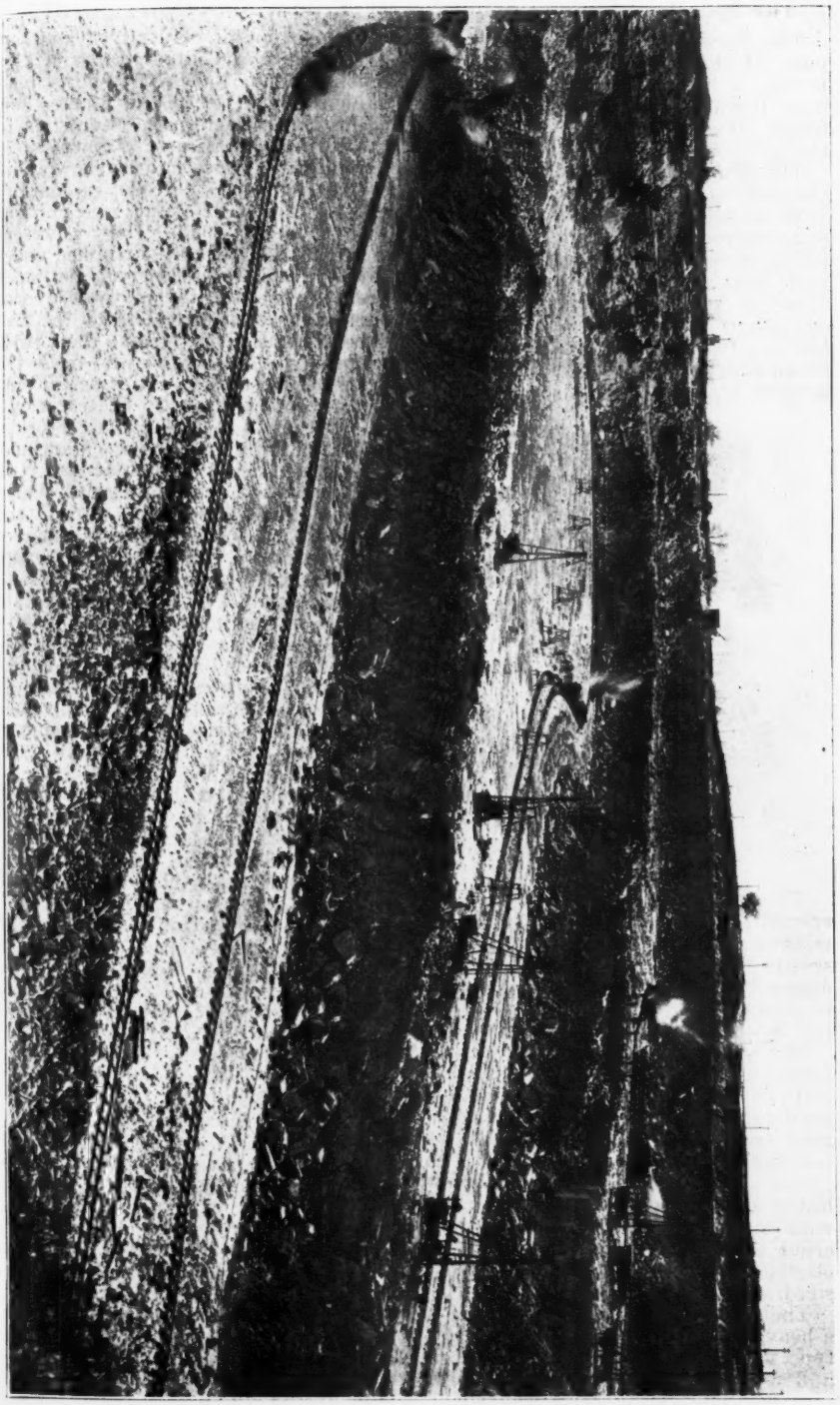
Conveying and Storage Equipment

An eight page bulletin entitled "Conveying and Storage Equipment to Conserve Dollars" has been received from The Stearns Conveyor Company, Cleveland, Ohio.

The following new units are described: the latest design of Stearns Roller Bearing Troughing Idler Pulley, with high pressure grease lubrication which permits it to run for many months without attenton, together with other important features; the new Stearns Roller Bearing Return Roller, having bearings interchangeable with each other and with those of the Stearns Troughing Idler Pulleys described above, throughout the entire range of belt-widths in use in conveyor installations; the "Holotile" Storage Bin, (a new and economical weatherproof type of storage unit); and the Stearns Self-Propelled Self-Reversing Belt Tripper.

H. J. Clark has been made district manager of the Bayley Mfg. Co., Milwaukee, with offices at 523 Penton building, Cleveland. For the past three years Mr. Clark has been district manager of the B. F. Sturtevant Co., in Cleveland, and previously was associated with the same firm in St. Louis, Kansas City and Chicago.

Showing Benching Method Employed by the Canada Crushed Stone Company

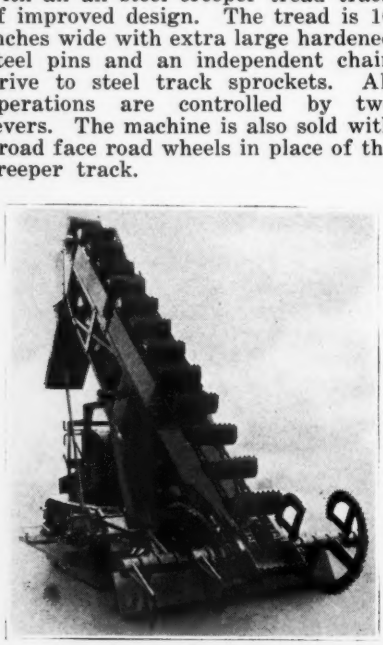


Showing Benching Method Employed by the Canada Crushed Stone Company

The Spearwell Mogul Loader

The Spears-Wells Machinery Company of Oakland, California, is marketing a loader embracing several new features including heavy type truck transmission and improved motor.

The frame is built of heavy steel channels well braced. It is quipped with an all steel creeper tread track of improved design. The tread is 10 inches wide with extra large hardened steel pins and an independent chain drive to steel track sprockets. All operations are controlled by two levers. The machine is also sold with broad face road wheels in place of the creeper track.



The propelling mechanism is a specially designed 5 ton truck transmission with multiple disc clutch, four speeds forward, two reverses, two digging speeds and a traveling speed in either direction from ½ to 2 miles per hour.

The elevator is a heavy trussed box frame carrying 27 high carbon steel 5-16 inch thick buckets of ½ cubic yard capacity and equipped with digging teeth. The chute is adjustable for either side or end loading. The power unit is a 35 H.P. four cylinder heavy duty gasoline motor equipped with an improved air clarifier, governor and high tension magneto. An electric motor can be provided if desired.

The digging and feeding device is a heavy manganese steel ribbon screw type with digging teeth mounted on a 3 3-16 inch steel shaft with new type self lubricating bronze bearings.

Production of Clay in 1924

The output of clay mined and sold as clay in the United States in 1924 amounted to 3,676,720 short tons, valued at $11,478,756, or $3.12 a ton, according to Jefferson Middleton of the Bureau of Mines, Deparment of Commerce. These figures show an increase of about 7 per cent in quantity and 3 per cent in value, as compared with those of 1923. They represent only clay sold as clay, or mined under royalty, and do not include the much greater quantity of clay that was burned into clay products by the producers themselves from their own property. The data was collected by the United States Geological survey in cooperation with State geological surveys of Alabama, Florida, Georgia, Illinois, Iowa, Maryland, Michigan, Missouri, New Jersey, New York, North Carolina, Virginia, Washington, and Wisconsin, before the transfer of the Mineral Resources Division of the Geological Survey to the Bureau of Mines.

The output of kaolin, the clay that is used in making high-grade pottery and porcelain as well as paper, oilcloth, and other products and is generally considered the highest grade of clay, amounted to 326,602 tons, valued at $2,923,965, a decrease of 3 per cent in quantity, as compared with 1923, with practically the same value as for 1923. The clay of largest production and value is fire clay. The output of fire clay was the largest ever recorded — 2,429,320 tons — and was 6 per cent greater than that of 1923 and 3 per cent greater than that of 1917, the year of largest output previous to 1924. The value of the fire clay output of 1924 was $6,708,283, an increase of 2 per cent, as compared with 1923, but a decrease of 5 per cent as compared with 1920, the year of greatest value of fire clay. The output of clay of every kind decreased in quantity and value in 1924 except fire clay and miscellaneous clay, which consists largely of clays used for heavy clay products such as building and drainage materials.

The imports of clay increased in quantity and value in 1924, as compared with 1923, and the exports decreased in quantity but increased in value. The imports of clay amounted to 444,100 short tons, valued at $3,976,040, an increase of 13 per cent in quantity and 8 per cent in value. Exports of clay in 1924 amounted to 72,755 tons, valued at $732,716.

The New Marion Model 125 Shovel

A LONG FELT NEED has been realized by the introduction of the New Marion Model 125. This shovel is full revolving, is mounted on crawler traction trucks, has large dipper capacity and is designed throughout for the hardest work and toughest digging.

Power and speed have been incorporated into the design to an astonishing degree while the construction is such that the main upper frame which carries all the machinery, including the boiler, piping and cap, can be shipped as one unit on railroad trucks. This calls for a minimum amount of erecting in the field.

The boiler, locomotive type, is standardly equipped with a fire brick arch. This feature is not only a fuel economizer but it eliminates tube troubles by preventing cold air from reaching the tubes while firing. The cleaning and replacing of tubes is easily acomplished without removing any piping as the boiler is located lengthwise on the rotating frame.

In traveling over uneven ground, the three point suspension on the front axle together with the crawler traction trucks are free to adjust themselves in a vertical plane without a tendency to create stresses or strains in the frame or cause a steering movement. This is made possible by a simple device on which patents are pending and which allows the axle to move only in a vertical plane, always parallel to the rear axle. In the crawler trucks, alloy steel frames with the same general construction as those used on the railroad crawler trucks, with 36 inch links are used. There is a simple adjusment to take up the slack in the belt.

The lower frame is constructed of 30 inch I-beams which are the deepest that are being manufactured today. The two side beams project at the corners to accomodate the jack castings and rear crawler bearing castings. Heavy 1 inch gusset plates cover the top of the frame. 80-lb rails make up the lower circle which has a diameter of 16 feet. There are 36 alloy steel rollers used and each is bushed and individually lubricated.

All beams are 24 inch and are entirely covered with heavy deck plates. An extra heavy center casting is rigidly bolted to the front frame gird-

The New Marion Model 125 Heavy Digging Shovel

ers. A cast-steel separator casting is located in the front and contains all the bearings for the rotating gears. Steel corner castings give added strength to the front cross girders which is bolted in its entire length to the longitudinal beams.

The hoisting engines are horizontal with a single gear reduction to the hoisting drum. The inside admission piston valves are specially large and well balanced. These valves are actuated by means of the Marshall valve gear which carries only one eccentric and no sliding parts. All pin connections in this valve gear have case hardened pins and hard bronze bushings.

All bearings in the hoisting machinery unit are fitted with half-brass shells and babbitted caps. This is a distinctive Marion practice and has been for years. It was first used about three years ago on the Marion Model 300.

The electric shovel is equipped with two motor generator sets driven by synchronous and induction motors, individual generators being supplied for the hoisting, swinging and crowding operations. Various motor speeds are obtained by the distinctive Marion controllers at the operator's station.

Marion modified shunt motors are standard on the hoist, swing and crowd. These shunt motors, as built for Marion by the General Electric Company, have proved themselves on the Marion Railroad type Shovels for the last two years, as being ideally suitable for heavy work. An electric trip motor is also standard on the electric shovels.

The hoist motor is connected to the hoist drum by means of a flexible coupling and a double reduction of herringbone gears. The first pinion shaft, intermediate shaft and hoist drum shaft are carried in renewable babbitted bearing shells of such proportions as to cut the maximum bearing pressures to standard mine hoist practice.

These main bearings are equipped with the flooded oil lubrication system similar in design to that of an automobile engine and consisting of a motor-driven oil circulating-pump, sump tank, conductor and drainage piping. A system such as this assures a continuous and copious flood of oil to each bearing.

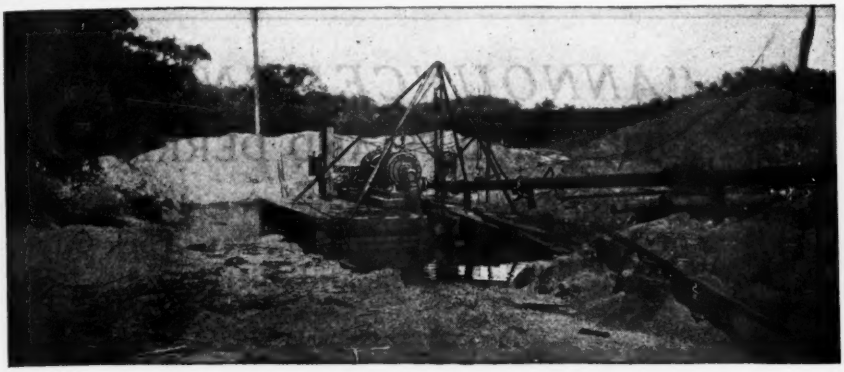
The boom is of all-steel construction consisting of two main members in the form of plate girders which are well trussed, braced and connected to each other by means of bulk heads, top and bottom plates. The foot casting is very large and wide and is stepped into a socket casting of similar design. The sheaves to the point of the boom and sheave block on the dipper are 36" in diameter.

Model 125 with its all-steel boom, fire arch, high pressure boiler, heavy gantry frame, extra large roller circle and improved hoisting unit with pressure oiling, is indeed a new era shovel. It is the largest and heaviest excavator that has ever been mounted on crawling traction trucks. The dipper handle is larger than those usually found on dippers of corresponding sizes and has a heavy casting at the end of which prevents warping and spreading members.

As a dragline with an 80-ft. boom, the Model 125 establishes a new standard for this class of excavating. Ample distance and a small angle of lead with the drag drum and fairlead insure minimum wear on cable and bearings. The shovel can very easily be converted into a dragline by changing the booms and adding the drag rum.

Weighing Material While On Conveyor

An interesting eight page folder issued by the Stearns Conveyor Company, St. Clair Avenue at East 200th Street, Cleveland, Ohio, describing the Messiter Conveyor Scale for weighing material while in process of being conveyed. This equipment, which can be applied to any bucket, belt, apron or other conveyor in which part of the conveyor-track can be freely suspended, is operated electrically, and is guaranteed to record true net weight within one-half of one per cent of total capacity. This exceptional accuracy is obtained by balancing the forward and return sides of the conveyor belt against each other on opposite sides of the scale beam, thus weighing only the actual material passing over the conveyor, and automatically deducting tare. A further advantage claimed is that, the registering device being electrically operated as stated above, it is an easy matter to have the recording instrument placed in any part of the plant which may be most convenient.



Way down in the wilds of Brazil

this 6-inch Morris Dredging Pump is taking sand from the bed of the Piranhas River and sending it to a storage pile, from which it is used in making concrete. Another larger (10-inch) unit is used to move material for a large earthen dam.

The fact that Morris Dredging Pumps were chosen by Dwight P. Robinson & Co. for use in this important Poco dos Paus irrigation project is a high tribute to the Morris product.

When such a prominent firm relies on Morris Pumps to do good work almost out of the realm of civilization and where repairing breakdowns would be matters of months, it is only logical that Morris Pumps are a safe selection for hydraulic sand and gravel production and earth handling anywhere.

We build types and sizes for delivering small or large quantity, and for hydraulic handling to long distances and highly elevated screens.

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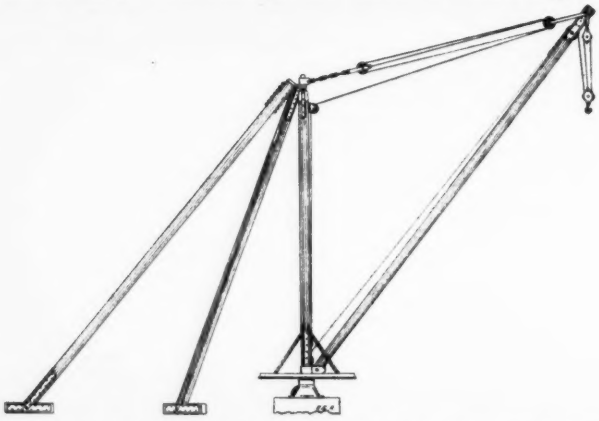
ELECTRIC HOISTS AND DERRICKS

Following Equipment Available for Immediate Shipment F.O.B. Shooters Island, New York City, Chicago, Philadelphia and Pittsburgh



Specifications of American Electric Hoists and Derricks

HOISTS

Large quantity late model American double-drum with attached swinging gear, capacity 6000 lbs. on single line at 162 ft. per minute; either hand levers or levers banked in quadrant. Can furnish either 37 H.P., 440 or 220 volt, A.C., 60 cycle, 3 phase, alternating current, or 35 H.P., 220 volt, direct current, or can furnish without electrical equipment suitable for gasoline or belt drive.

CARS

12—36-in. ga. Continental, 4 yd., heavy duty, rebuilt like new.

15—Lakewood 30-in. ga., V shape, 1½ yd., all steel Dump Cars.

STEAM SHOVELS

3—78C late '23 models, 30-ft. boom, 19-ft. dipper stick, 3-yd. dipper, one on railroad trucks, two on caterpillars.

1—50B Bucyrus full revolving on caterpillars, 26-ft. boom, 17-ft. dipper stick, 1¾-yd. dipper new November, 1923.

DERRICKS

Large quantity late model American Stiff Leg Derricks, mast 14 x 14 x 40 ft., booms 14 x 14 x 60 ft., stiff legs 14 x 14 x 50 or 60 ft., sills if desired, with 12 ft. steel bull wheel, for hook work or bucket operation.

Large quantity late model American Stiff Leg Derricks, mast 16 x 16 x 40 ft., boom 14 x 14x80 ft., trussed with hog rods, legs and sills 14 x 14, with 16 ft. steel bull wheel, arranged for hook work or bucket operating.

LOCOMOTIVES

3—Porter 36-in. ga., 18 ton, saddle tank, 10 x 16 cylinders, rebuilt like new. Nos. 4619, 4667, 6804.

1—Davenport std. ga., 20 ton, 10 x 16 cylinders, saddle tank. No. 1497.

6—Porter std. ga., saddle tank, 14 x 22 cylinders, weight 42 tons, like new, only one year of service, shop Nos. 6768, 6769, 6770, 6771, 6772 and 6773.

3—7 ton, 24-in. ga., Plymouth, gasoline.

4—3 ton, 24-in. ga., gasoline, 2—Plymouth, 1—Whitcomb and 1—Fordson.

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FLAT CARS and BATCH BOXES	LAKEWOOD TAMPER and FINISHING MACHINE	CONCRETE MIXER
AIR COMPRESSORS		HEATING PLANTS
HORIZ. TUBULAR BOILER	DUMP BUCKETS	STEAM PUMPS
20,000 GAL. CYPRESS TANK	PRESSURE TANKS	FIRE PUMP

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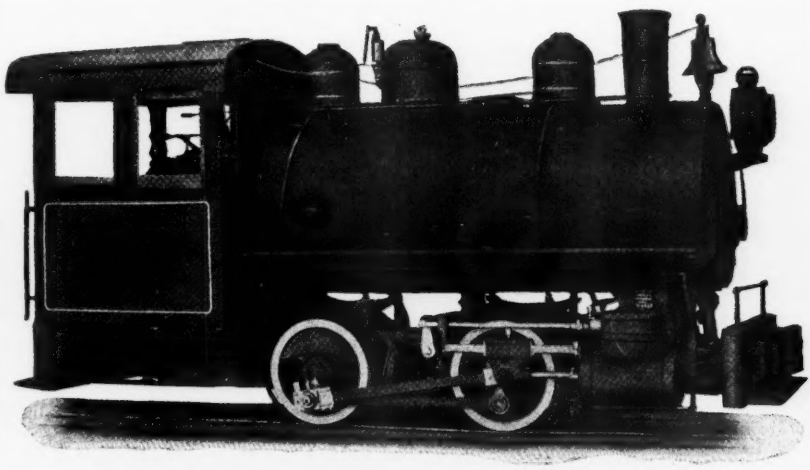

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Three No. 1, Two No. 1½ and One No. 2 Sturtevant Rotary Fine Crushers.

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Three 9"x15", One 10"x20", Two 12"x24", One 15"x30", One 18"x36", One 24"x36", and One 36"x42" Jaw Crushers.

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Two 3'x20', Three 4'x30', One 5'x25', One 5½'x40', Two 6x60', and One 7'x60' Direct Heat Rotary Dryers. One 5'x25', One 6'x30' Ruggles Coles type "A" and one 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.

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One 4'x40', One 5'x50', Two 6'x60', One 6'x125', One 7'x60', Rotary Kilns.

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BROWNHOIST No. 9359, 7-ft. gauge, 4-wheel, ASME boiler, double drums, 44' 6" boom, complete with 1½ cu. yd. clamshell. Like new. Used less than 6 months.

OHIO 20-ton cap., 50' boom, double drums, 8-wheel MCB, Massachusetts boiler. One year old. First class condition.

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1—20-ton, 8-wheel, OHIO Locomotive Crane, Shop No. 3631, new 1924, A.S.M.E. and Mass. boiler, 50 ft. boom; bucket operating; M.C.B. trucks, perfect condition.

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177 ft. Ingersoll, "ER-1."
360 ft. Chicago, "NSB" with motor complete.
528 ft. Ingersoll, "ER-1."
599 ft. Ingersoll, Imperial "XB-2."
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1—Lidgerwood engine, 10x12, double drum, with boiler.

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1—1 yard Sauerman drag, with cables, sheaves, and everything for a complete slack line dragline. This equipment used 90 days.

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1—Gates No. 4.
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84x72, 36x60, 54x24, 18x30

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22x52", 36x42", 42x45", 20x24", 15x36"

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2-cylinder double end single stage air compressor, 140 cu. ft. capacity, also one with 200 cu. ft. capacity.

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1—8½x10 three drum and boiler Lambert.
1—10x12 D. D. and Swinger Skeleton Lidgerwood

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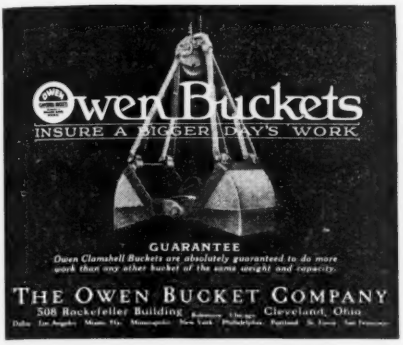
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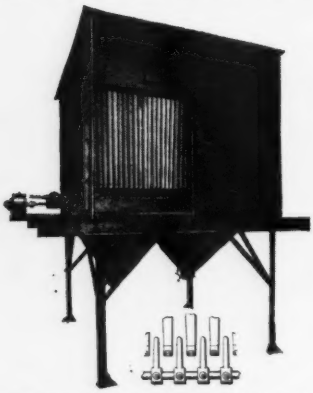

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In many industries this collection of dust represents a direct saving of money—resulting from the recovery of otherwise lost values, and from the increased efficiency of labor as affected by improved sanitary conditions.

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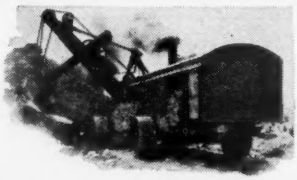

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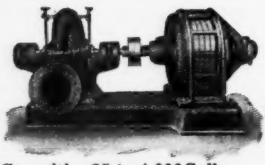

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6″ to 12″

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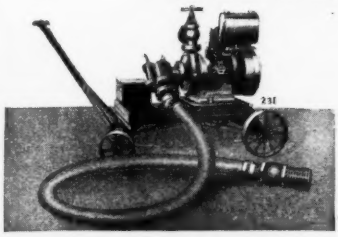

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The Gayco Separator Is Built in Six Sizes—Products from 80 to 325 Mesh

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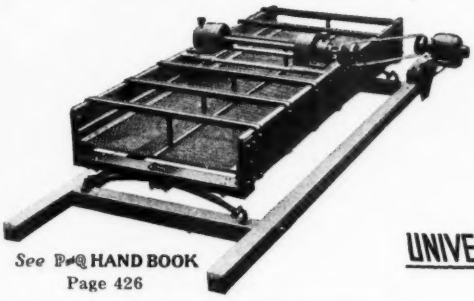


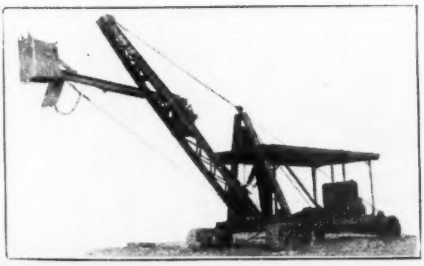
See P&Q **HAND BOOK** Page 426

Universal Vibrators

For the very highest screening efficiency with the lowest maintenance cost.

Write for Descriptive Catalog Today.

UNIVERSAL VIBRATING SCREEN CO.
RACINE - - WISCONSIN



BAY CITY ONE MAN EXCAVATOR

Operates Shovel—Clam—Dragline ½-yd. Capacity

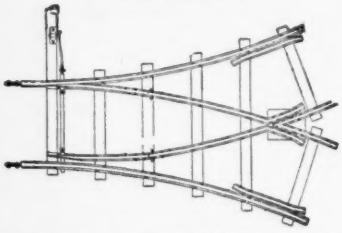
Fills the gap between hand labor and high priced equipment. Several hundred in operation, gasoline or electric power.

BAY CITY DREDGE WORKS
BAY CITY, MICH.
See P&Q **HAND BOOK Page 333**

Kilby Frog and Switch Company

Birmingham, Alabama

Manufacturers of



We make a specialty of track material for all kinds of Industrial Tracks—such as Frogs, Switches, Switch Stands, Rail Braces, Crossings, Crossovers, Room Turnouts, Portable Track, Etc.

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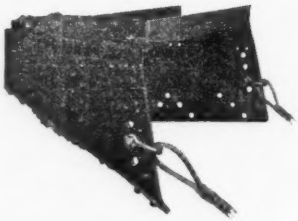
GREEN POWER DRAG SCRAPER



The Power Drag Scraper has proven surprisingly economical and efficient over a wide range of applications.

Evidence of economy in many installations are shown in our catalogue. Send for your copy.

L. P. GREEN

Monadnock Block **Chicago, Ill.**

The extra output a WILLIAMS gives

pleases everybody

Everybody around the plant likes the WILLIAMS better— the producer, his superintendent, and the crane operator— because this is the bucket for (1) more digging power, (2) faster action, and (3) steady work.

For instance, J. W. Driskell, Supt., Steubenville Sand Co., Brilliant, Ohio, writes: "No other make of bucket we have used can compare with the WILLIAMS for service— the WILLIAMS Bucket we have used for digging gravel since 1910 is working like new."

In the complete WILLIAMS line you are sure to find the right bucket for your work. Tell us the material you have to dig and output you need, and we will recommend a bucket that you can *depend on*.

G. H. Williams Company
605 Haybarger Lane,
ERIE, PA.

Eastern Office: 30 Church St. N. Y.

WILLIAMS
FAST-DIGGING BUCKETS
All Parts Guaranteed Against Breakage

STEEL BINS

85, 135, 210 and 300 Ton Capacities.

All-steel-hopper-bottom-self-cleaning.

Equipped with a no-jam gate.

Use BLAW-KNOX long service Clamshells.

BLAW-KNOX COMPANY
652 Farmer's Bank Bldg.
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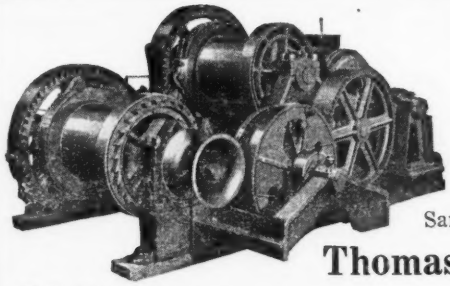
BLAW-KNOX



Thomas Hoists

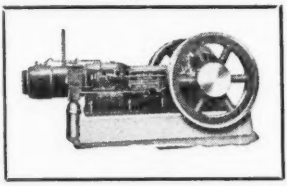
Steam and Electric

Single and two-speed types designed and built to meet every requirement of the Sand, Gravel and Stone Producer.

Thomas Elevator Company

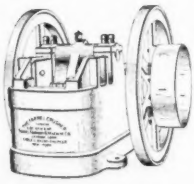
20 S. Hoyne Avenue — Chicago, Illinois

Buckeye Oil Engines Are Favorites



Single and two cylinder 55 to 260 H. P.
Horizontal accessible design with adjustable cross-head.
Cost least for repairs.
Burns low grade fuel.
One gallon lubricating oil operates 90 h. p. for 33 hours.
Write for catalogue.

THE BUCKEYE MACHINE COMPANY — **Lima, Ohio**



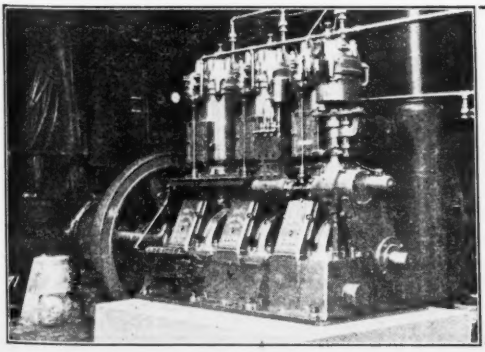
"FARREL" CRUSHERS

—World Famous—

Thousands in use on the hardest rock. Built in all sizes, 6″x3″ to 60″x48″. Complete rock crushing plants designed and equipped, also sand and gravel, washing and screening plants.

Send for latest bulletin E.

Earle C. Bacon, Inc., Engineers, 26 Cortlandt St., New York



TIPS OIL ENGINES burn low grade fuels. Solid Injection. 40—165 H.P. Sizes suitable for operating dragline excavators, hydraulic dredges and all stationary work. Variable speed, 100% water-cooled heads, no torches, Chrome-Vanadium crankshafts.

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TIPS ENGINE WORKS
AUSTIN, TEXAS

Agents in all principal cities

A Happy Drilling Combination—

of easy operation and rapid, hard biting drilling ability. Wood Drills will please your drill runners because of their easy operation. They will please you because of their drilling qualities and durability. *Write today for details and prices.*

WOOD DRILL WORKS, 30-36 Dale Ave., Paterson, N. J.

Makers of Hammer Drills and Piston Drills

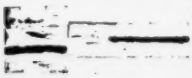
Crushing and Grinding
Material Handling
Old Equipment Modernized
Properties Examined

C. H. SONNTAG
Engineer
Cape Girardeau, Mo.

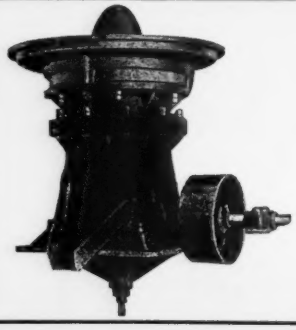
Portland Cement Plants
Electric Power Transmission
Power Plants
Waste Heat Boilers

PULVERIZERS

FOR AGRICULTURAL LIMESTONE
ASPHALT FILLER
ROCK DUST FOR MINES
THE GRIFFIN MILL—BRADLEY 3 ROLL
BRADLEY HERCULES MILLS
OUTPUTS—1-40 TONS PER HR. FINENESS—20-200 MESH



BRADLEY PULVERIZER COMPANY
BOSTON *Works:* ALLENTOWN, PA. LONDON



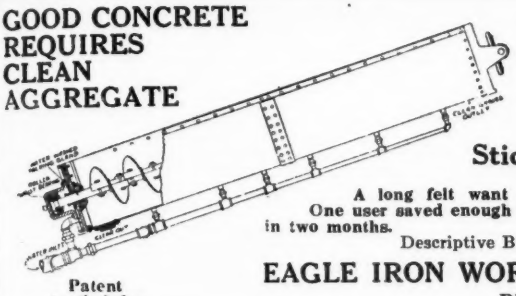
AUSTIN
Gyratory Crushers
Portable and Stationary Plants

Capacities, 5 to 300 tons per hour

Catalog 29Q tells the whole story. Write for your copy today.

AUSTIN MANUFACTURING CO.
NEW YORK CHICAGO SAN FRANCISCO

GOOD CONCRETE REQUIRES CLEAN AGGREGATE



Patent Applied for

The EAGLE WASHER

Removes Mud Balls, Sticks, Coal and Shale.

A long felt want that actually does the business. One user saved enough to pay for the cost of this washer in two months.

Descriptive Bulletin now ready.

EAGLE IRON WORKS, Des Moines, Iowa

DEPT. P

The "CLIPPER"

late improved Blast Hole Drill. The "CLIPPER" predominates, has stood the test, and is approved by critics. Furnished also in the round wheel.

(Established 1842)

THE LOOMIS MACHINE CO., 15 Market St., Tiffin, Ohio

McGANN MANUFACTURING COMPANY, INC.
Engineers and Manufacturers
CHICAGO YORK, PA. NEW YORK

YORK DOUBLE SHELLED DRYERS, manufactured and installed by us, dry any materials thoroughly and uniformly at a minimum operating cost. Put your drying problem up to us.

YORK Kiln | SCHULTHESS Hydrators | YORK Double Shell Dryers

Milwaukee Gasoline Locomotives

For Industrial Haulage

BUILT in sizes from four to fifteen tons. For all Gauges of Track. There's a size for every purpose.

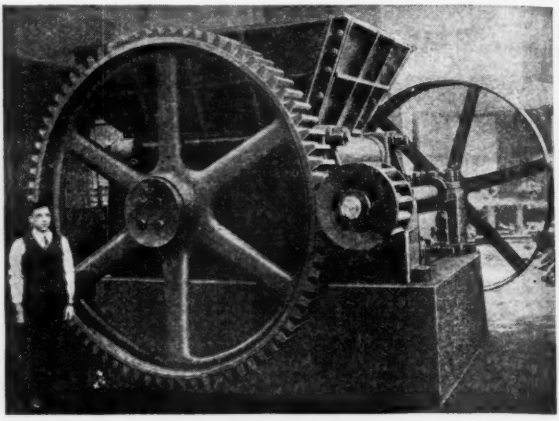
Write for Catalogs M-129 and M-136.

MILWAUKEE LOCOMOTIVE MFG. CO. MILWAUKEE WISCONSIN

The Ideal Stone Crusher

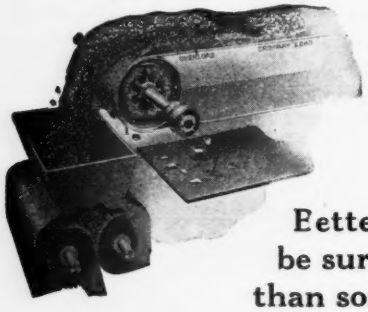
The ideal crusher for small or large operator is the McLanahan Single Roll Crusher, for use on material not harder than limestone or dolomite. Many years of practical crusher building experience are behind this machine, and it has won its way with stone crushing operators strictly on merit. It is strong and well built, with heavy gearing. The roll shell is a solid cylinder of chilled charcoal iron. It is a machine of many excellent qualities.

You will be interested in reading our literature describing our line of crushers, screens, washers, elevators and other equipment.



McLANAHAN-STONE MACHINE CO.
HOLLIDAYSBURG, PA.

HIGH DUTY Magnetic Separators



Better be sure than sorry

One piece of scrap iron may cost you more in crusher repairs than the absolute safety offered thru the purchase of a High Duty Magnet Pulley.

The ventilation feature now used increases the magnetic power 25% to 50%, providing absolute safety even with peak loads.

Offices in principal cities
See telephone directory

MAGNETIC MFG. CO.
201—24th Ave. Milwaukee, Wis.

EGYPTIAN IRON WORKS
MURPHYSBORO, ILLINOIS

Manufacturers of

QUARRY EQUIPMENT

and Semi-Steel, Grey Iron Bronze and Brass Castings.

WHEELS { Quarry Car, Sheave, Traveling Crane, Channeling Machine, Drag Saw, etc.

SWITCHES—REID CAST SAFETY FROGS

Write for prices

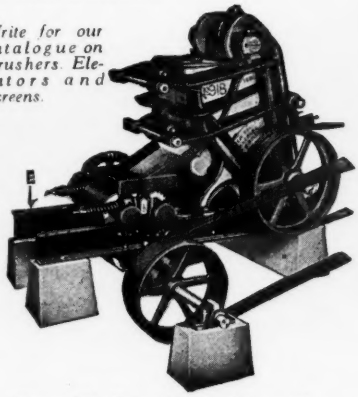
QUALITY — SERVICE

=New Holland=

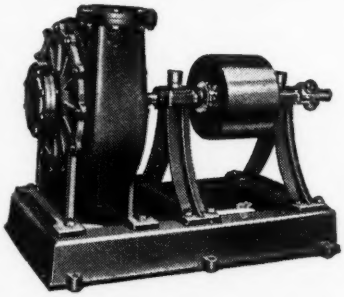
Long powerful stroke
Big Capacity

The New Holland Swing Jaw Crusher is strongly made, and designed for long, powerful strokes, giving large capacity. It is designed to crush all kinds of rock, hard or soft, into any size down to dust. Made in five sizes.

Write for our catalogue on Crushers, Elevators and Screens.



New Holland Machine Co.
Franklin Street, New Holland, Pa., U. S. A.



THE LIGHTNING PUMP

Will strike you a superior pump for sand and gravel dredging because of its greater capacity and simplicity.

Lightning pumps have certain features of construction—collars to avoid end thrusts—shafts with reversible ends—that give them a decided advantage over other makes.

There are other equally advantageous features peculiar to Lightning pumps that you should know about. Write to-day for pump bulletin.

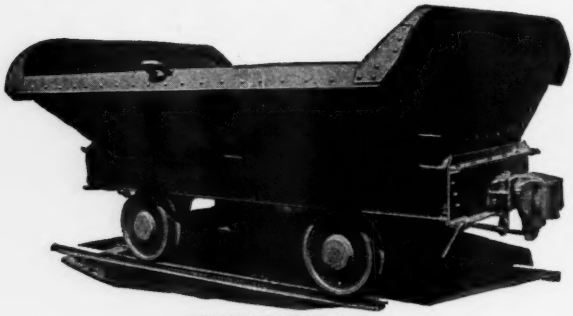
KANSAS CITY HAY PRESS CO.
KANSAS CITY, MISSOURI

FOR
DRAG LINES
POWER SHOVELS
DERRICKS

AMERICAN STEEL & WIRE COMPANY

Chicago New York

EASTON QUARRY CARS



PHOENIX TYPE 5794

Bulletin 21

Shows other types of quarry cars. Sent on request.

"Quarry Car Practice"

Published Every Now and Then

HELP

We have wearied of this overworked word "service." Why use a two-syllable ditch-delivered Latin derivative with a simpler word of sturdy Saxon stock at hand better to express your meaning?

Help in haulage problems is what we offer. A rich fund of experience is ours to draw upon after years of specialization in the art of quarry-car building.

EASTON CAR & CONSTRUCTION CO.

KANSAS CITY, MO. and EASTON, PA.

Offices

New York Chicago Pittsburgh Philadelphia San Francisco

EASTON CARS

FOR EVERY PIT MINE & QUARRY

102,780 tons of shale being moved at quarry of Colorado Portland Cement Company by 17,890 pounds of explosive

Cordeau was used to detonate the explosive charges in the thirty-nine well drill holes and assisted in accomplishing these fine results.

For Safety and Efficiency, use Cordeau-Bickford, and the results obtained will satisfy you that Cordeau-Bickford is an efficient detonating agent.

The Ensign-Bickford Company

Original Manufacturers of Safety Fuse

Established 1836

SIMSBURY, CONNECTICUT

A satisfied user since 1922

The Interstate Crushed Stone Company has been using Brookville Locomotives since 1922. Mr. Bamberger, President says:

"Regarding the Fordson Locomotive purchased from you in August 1924, this locomotive has been in continuous service since that time, excepting three months during the winter when the plant was not in operation, and has given entire satisfaction. As our haul is hard we are only hauling one car at a time, the cars weigh 3600 lbs. and carry 3 tons of stone, but the locomotive will easily pull two of these cars.

"We also have two of your Ford Ton Truck locomotives in service, one machine being purchased during 1922 and the other in 1923. These machines are also very satisfactory, but not as rugged and strong as the Fordson."

You too will find a Brookville satisfactory. Write for details.

BROOKVILLE TRUCK & TRACTOR COMPANY
BROOKVILLE, PA. U. S. A.

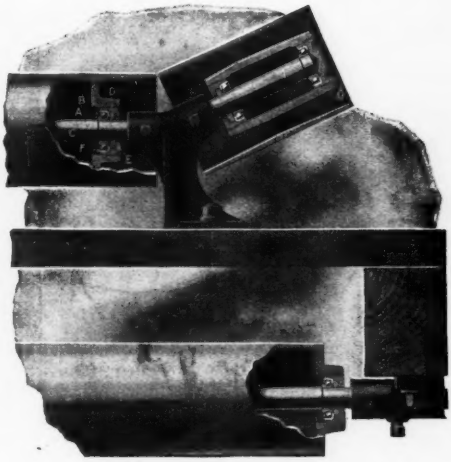
Eliminate Idler Friction with Conweigh Ball Bearing Idlers

More and more the demand in plant equipment is for intensive development and greater perfection in details. Conweigh Ball Bearing Troughing and Return Idlers represent a detail improvement which affects the whole conveying system of a plant. Because of the smooth, easy service they give, belt conveyors operate with far greater efficiency.

Conweigh Ball Bearing Idlers are smooth running, and durable, being made of hardened steel well reinforced. They give easy access for lubrication.

Get complete details on "Conweigh" Idlers. Made in all sizes. Write today.

We are the original inventors and builders of belt conveyors equipped with ball bearing idlers.



Write for detailed information

THE CONVEYING WEIGHER COMPANY
90 West Street ENGINEER & CONTRACTOR **New York**

DOLLARS *In YOUR* POCKET

SALEM

ELEVATOR BUCKETS

You save money by using Genuine Salem Elevator Buckets. In 1880, Salem Buckets were awarded First Premium for superiority. Since then no other make has approached them in quality, long wear and unusual service.

Fig. 165—Reinforced Back for heavy work when carried by the back or subject to severe strains.

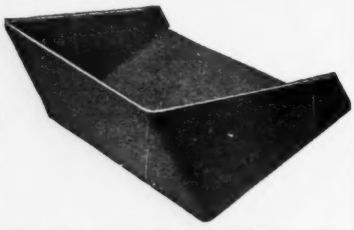


Fig. 131—Square Heel Shelf bucket. Especially adapted for handling damp materials.

MULLINS BODY CORPORATION

Successors to W. J. Clark Co.

106 Mill Street **Salem, Ohio**

Immediate deliveries made from our large stock of standard sizes and gauges, special types made to order promptly.

Write for Catalog No. 3625

BURCH PORTABLE LOADER

Easy to Transfer Easy to Install

The new type all-steel loader, designed for stone, gravel, sand, slag, and coal should appeal to any pit or quarry operator who has these materials to load and unload from cars, or from stock piles or pit, to or from wagons or bins. Their portability and easy adjustment to low or high position make them particularly desirable.

Operators like the Burch Loader because it will easily convey one yard per minute when properly operated (according to the kind of material) and requires only the partial time of one man.

Write for catalog and prices.

THE

BURCH PLOW WORKS CO.

CRESTLINE, OHIO.

BURCH AMAZON DRILL

DEPENDABLE "DOMESTIC" POWER UNITS

You need a good pump at your plant

A "DOMESTIC" Pump will remove all the water that accumulates around the quarry. It makes no difference if it contains mud, sludge, silt, clay or what-not,—a "DOMESTIC" Pump will handle it.

You should have a "DOMESTIC" because it has large capacity and discharges through long pipe or hose line to disposal point and makes no slop or odour. You need one also for your fresh water supply. "DOMESTIC" Double Acting Force Trench Pumps have large capacity and minimum weight.

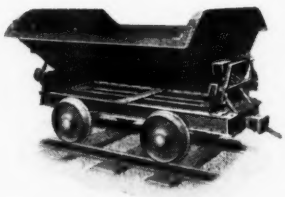
Send for Bulletin "TP" to help you solve your pump problem.

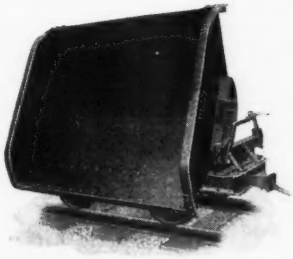
"Domestic" 4-TF Double Acting Force Trench Pump Unit

Domestic Engine & Pump Co.

Manufacturers

SHIPPENSBURG, PENNA.





TIECO QUARRY CARS

Built To Stand Up Under All Conditions.

There are no better cars built for quarry use than our type "Q" cars and price is no more than for inferior makes.

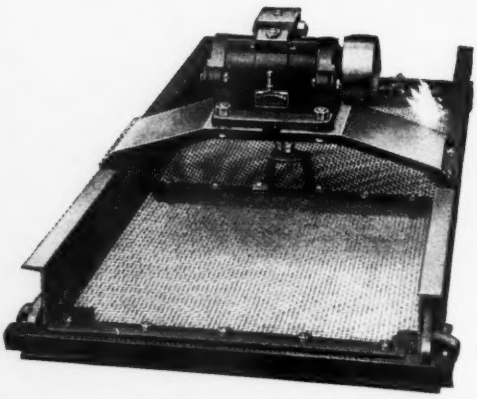
Frames of heavy ship channel, bodies of heavy steel plate, bronze bearings, all castings of steel.

Write for Prices and Literature

THE INDUSTRIAL EQUIPMENT COMPANY

MINSTER, OHIO

Leahy NO-BLIND



VIBRATING SCREENS

Screen Everything — Wet or Dry

VERY LOW POWER CONSUMPTION

Write for Bulletin No. 12

THE DEISTER CONCENTRATOR COMPANY

635 High Street
FORT WAYNE, INDIANA

New York Office:
60 Water St.

WOVEN WIRE SCREENS

Properly chosen screens save Power, Attendance, Investment and Replacement costs, improve your product and increase your output.

Catalogue No. 47-E is a Text-book on Screens. It's free. Get your copy from the first edition.

The LUDLOW-SAYLOR WIRE COMPANY St. Louis
610 South Newstead Avenue

CYCLONE NUMBER FOURTEEN BIG BLAST HOLE DRILLS

Whatever success Cyclone No. 14 Big Blast Hole Drills have attained in the quarry industry during the fifteen years of their existence has been due to close adherence to the following ideals and principles:

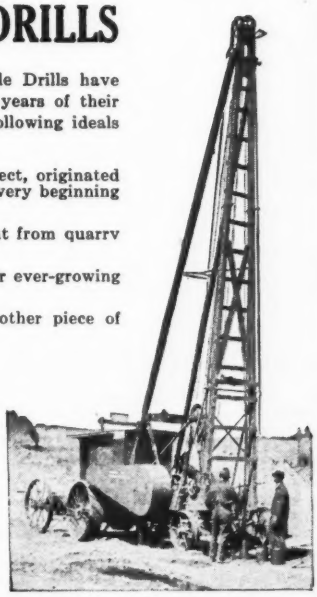
1—Starting with a design that was basically correct, originated after a close study of the requirements at the very beginning of the use of well drills in quarrying.

2—Always welcoming suggestions for improvement from quarry operators.

3—Keeping in close touch with the field and their ever-growing requirements.

4—Never holding the idea that a drill or any other piece of machinery could be perfect or faultless.

The story of the development of Cyclone No. 14 drills is completely told in our 100-page catalog B-45. It also contains 40 pages of cost and operating data on quarry drilling and blasting. Ask for a copy.



THE SANDERSON-CYCLONE DRILL CO.

Orrville, Ohio

Eastern & Export Office:
30 Church St., New York City

SPEARWELL MOGUL LOADER

A Strictly One Man Machine

CAPACITY 1½ to 2½ CU. YDS. PER MINUTE
Weight 14,000 lbs.

Equipped with positive and efficient excavating, feeding and cleanup device.

Clears path 8 feet wide.

Guaranteed to excavate harder material and to clean up better than any loader of its kind on the market, bar none.

40 H.P. 4 cyl. Heavy Duty Buda Motor.

Positive self-cleaning track, 1500 square inches of bearing surface, less than 10 lbs. per square inch.

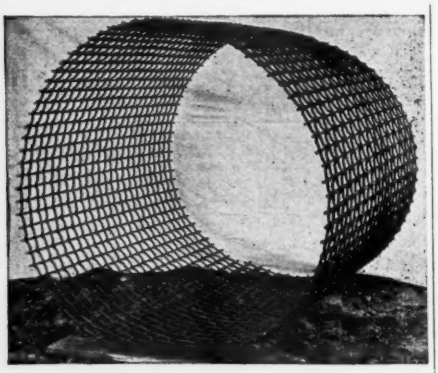
Digging and crowding speeds 4 and 20 ft. per minute. Traveling speeds ½ to 2½ miles per hour.

Digging position quickly and easily adjusted and absolutely maintained by special grade control shoe.

Swivel chute controlled from operator's platform, permits loading in any position.

Write for literature and prices on Spearwell Loaders—a size for every need.

SPEARS-WELLS MACHINERY CO.
Manufacturers of SPEARWELL CONSTRUCTION EQUIPMENT
Oakland, California



TRADE ROL-MAN MARK

ROL-MAN SCREENS
Double Lock Mesh
Manganese Steel

From 50 to 150 per cent greater production is secured from Rol-Man Manganese Steel Screens than from perforated metal screens.

Owing to their design the wear side is practically smooth and flat as plate, making the wear evenly distributed.

In addition, they are more economical in operation and produce a cleaner, more uniform product.

Being made of rolled manganese steel rods they have highest abrasive resistance and double the strength and stiffness of ordinary commercial woven wire screen cloth.

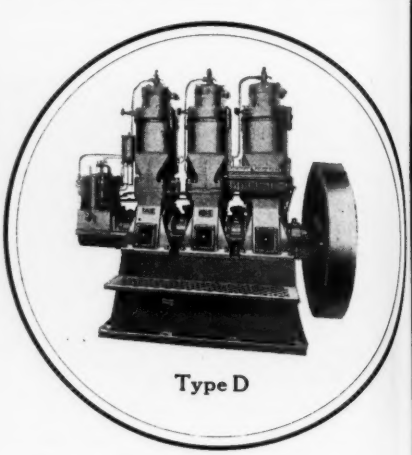
Rol-Man Screens are made in all shapes, and with openings 3-16 inch or larger. Send for catalogue which shows unique construction and important features.

Cross section view of lock mesh

MANGANESE STEEL FORGE CO.

Richmond St. & Erie Ave.,
PHILADELPHIA, PA.

VENN-SEVERIN OIL ENGINE



Type D

"Best internal— combustion engine"

The plant superintendent of an Iowa construction company says the Venn-Severin engine is the best internal combustion engine he has ever had anything to do with.

This is what the president of the company reports: "This is the third season that we have used this engine to operate an eight-inch centrifugal pump. Personally, I think you have a first class engine and I am glad to speak a good word for you."

If you want to know how and why the Venn-Severin is a superior engine send for our Type "D" bulletin which gives many reasons. It will show you how the Venn-Severin will meet your power requirements.

Especially adapted to Dragline work.

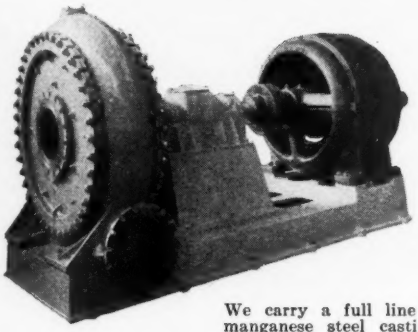
Sizes range from 15 to 250 H. P.

VENN-SEVERIN MACHINE CO.
1317 West North Ave.
CHICAGO

THE ECONOMICAL POWER UNIT

PMC Manganese Steel Castings

DIAMOND Sand and Gravel Pumps



We carry a full line of manganese steel castings at reasonable prices.

Diamond Pumps are strong and serviceable. They are made of the toughest and most enduring metal made—Manganese Steel—and are designed and built on approved engineering lines.

Diamond Pumps are built in all sizes, with belt drive or direct connected motor drive.

If you are interested in pumps, send your inquiries to—

W. H. K. BENNETT
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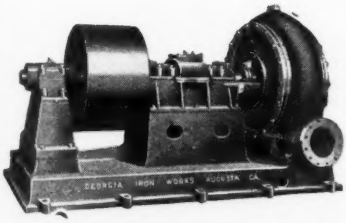
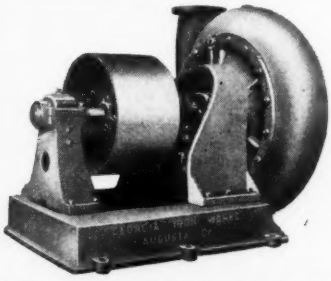
PETTIBONE MULLIKEN CO.
Chicago, Ill.



Heavy duty belt driven sand and dredging pump built in 8", 10", and 12" sizes.



Overhanging type belt driven sand and dredging pump. Built in 6" and 8" sizes.

SAND PUMPS

The accompanying cuts show two very popular types of belt driven units. These pumps are also built with bases for direct connection to motor.

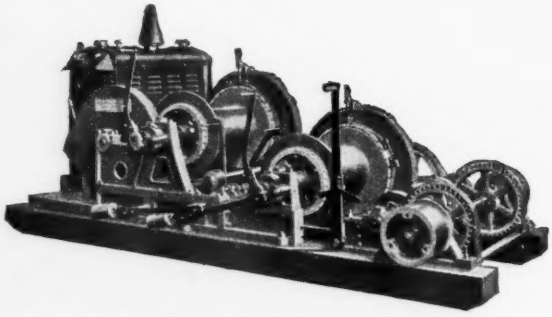
Send for illustrated catalog showing our complete line of this equipment including flanged pipe fittings and hydraulic guns.

GEORGIA IRON WORKS
AUGUSTA, GA.
Established 1891

LIDGERWOOD HOISTS

Steam—Electric—Gasoline

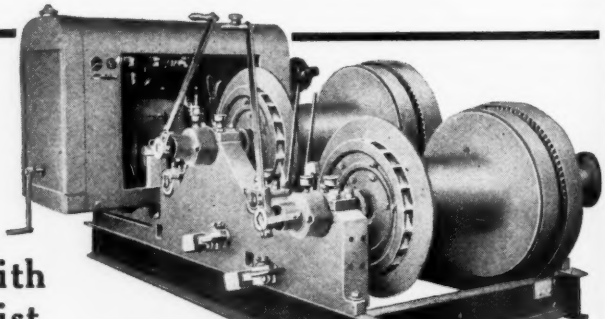
Built in Types for Every Contractor's Service



They do their work to your Profit

LIDGERWOOD MFG. CO., 96 Liberty St., New York

Chicago; Pittsburgh; Philadelphia; Detroit; Los Angeles; Seattle; Tacoma; Portland, Ore.; Brown-Marx Bldg., Birmingham, Ala. **Sales Agents:** Norman B. Livermore, San Francisco; Woodward, Wight & Co., New Orleans, La.; John D. Westbrook, Inc., Norfolk, Va.; Canadian Allis-Chalmers, Ltd., Toronto. **Foreign Offices:** Sao Paulo, Brazil; Rio de Janeiro, Brazil; London, Eng.



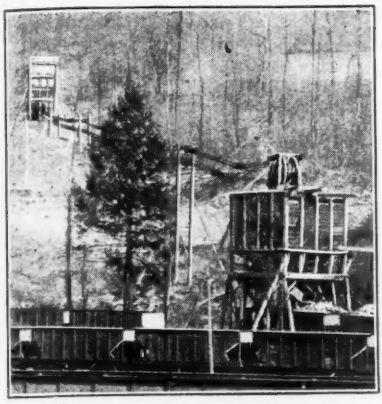
Your Hoisting Problems Disappear with an O. K. Hoist

Breakdowns are very costly. Avoid them by using O. K. Hoists. Cheap hoists always have a habit of falling down on the job just at a time when minutes are worth money. O. K. Hoists are the most economical because of their ability to stand the gaff and give 100 per cent results—due to scientific design and honest construction.

All O. K. Hoists are sturdy, comparatively light in weight and easily removed from place to place. No experts are required for operating, and any garage is able to repair and adjust O. K. Hoists. Send for full information.

O. K. CLUTCH & MACHINERY CO.

BOX 305, COLUMBIA, PA.



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For all drilling and other quarry operations requiring pneumatic tools—use compressed air supplied by a Curtis Model "A." Fully enclosed Controlled Splash Oiling Compressor.

Curtis Model "A" Air Compressors are the result of over 28 years spent in the design and manufacture of air compressors known everywhere for their advanced engineering features, extreme durability and all-round mechanical excellence. They are full self-oiling through means of a controlled splash regulatable sight feed lubrication system. Heads, valves and cylinder walls are water cooled and present a greater cooling surface than in double-acting compressors of equal capacity. This feature increases volumetric efficiency. Fully enclosed—dust and dirt proof. Built in various sizes and capacities up to 250 b. displacement.

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Branch Office:
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Model "A"

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Curtis Pneumatic Machinery Co., 1628 Kienlen Ave., St. Louis, Mo.

Gentlemen: Please send full details on Curtis Air Compressors.

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CALDWELL Buckets are built to give efficient performance under trying tests and widely varying conditions.

The Continuous Steel Bucket is especially adapted for handling cement, stone, crushed rock and other heavy material, and is made in various gauges of steel, to suit all requirements. They are accurately formed, and joints may be either riveted or spot welded.

No wedging of material, or sharp corners. May be arranged to overlap, thus forming a continuous bucket elevator. Loads fully, with even, complete discharge.

When considering bucket equipment, for any or all needs, remember the name, CALDWELL. Remember, also, the names of Caldwell users, gladly furnished on request.

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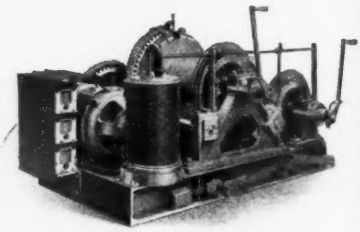
CALDWELL

"O. & S." Electric Hoists



Our line of Electric Hoists ranges in capacity from 350 to 6500 pounds on a Single Line. We furnish the Hoists with or without Motors. We use Motors of prominent make such as the General Electric, Westinghouse or their equal. The Hoists are built in types necessary for all purposes.

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Not to do the work of a large shovel—But to do the work a large shovel can't do—PROFITABLY

WHERE the yardage doesn't justify a large shovel yet is too much to handle economically by hand or teams, the INSLEY EXCAVATOR fits all requirements **including** your pocket-book.

Being one man operated it is of low operating cost, and while light in weight and easily moved, it is of staunch construction and can be depended on to stand up to the work for which it is designed.

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